MODERN PLASTICS

August 1956

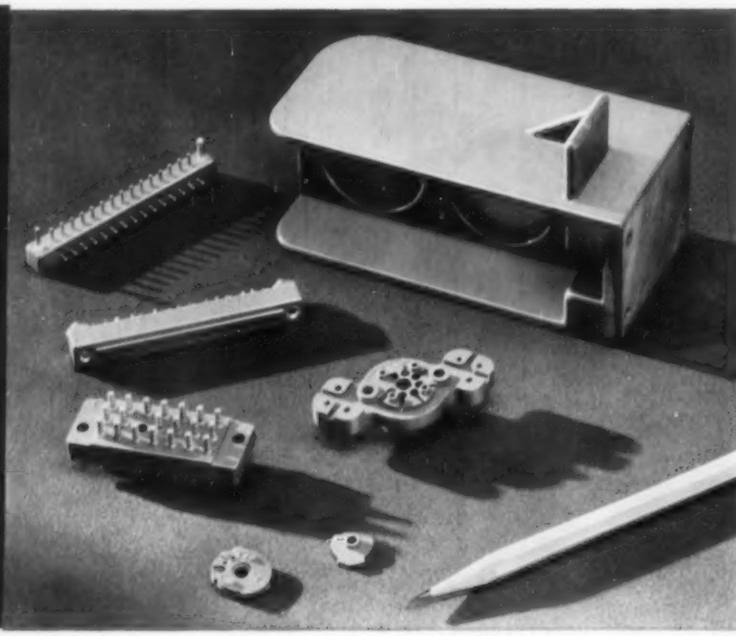
For ELECTRICAL SERVICE

under conditions of

PROLONGED HIGH HUMIDITY

DUREZ 16694

green diallylphthalate orlon-filled thermosetting



DESCRIPTION: This is a green orlon-filled diallylphthalate molding compound in granular form.

PROPERTIES: With a short-term volume resistivity of 1×10^{16} ohm-cm., Durez 16694 has long-term (720 hours at 100% R.H. at 70°C.) test properties as follows:

- Volume resistivity, ohm-cm. . . . . 6×10^{12}
- Surface resistivity, ohms . . . . 2×10^{12}
- Insulation resistance, ohms. . . . . 1×10^{11}

The exceptional electrical properties of the molded material are combined with mechanical, thermal, and chemical characteristics that make "16694" of particular interest to the electrical design engineer. Field tests indicate the material stands up well where machined surfaces are involved. It also has excellent resistance to many acids and alkalies.

APPLICATION: Because of its unique combination of electrical and other properties, Durez 16694 can be expected to serve best in applications subject to unusually severe conditions of exposure to high humidity. In addition, it will not corrode sealed-in metal inserts.

The material meets the requirements of military specification MIL-M-18794, Type SDI-5. At temperatures of approximately 300°F., it molds readily in compression presses.

FURTHER INFORMATION including test data on this new material will be supplied gladly on request.

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MODERN PLASTICS*

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Number 12

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Another new development using

B.F.Goodrich Chemical *raw materials*

"Play Pool" is manufactured by Hettrick Manufacturing Company, Toledo, Ohio; uses Geon-coated nylon furnished by Electro Plastic Fabrics, Inc., Pulaski, Va.

In the swim with Geon coated fabric

NOW textiles are being extended to many new applications—by virtue of coating with Geon polyvinyl materials.

This new Play Pool, one of the first of Geon-coated nylon, is a lightweight considering its size, so it is easy to handle. The Geon coating makes the fabric waterproof, resistant to wear and tear, impervious to mildew, provides long lasting color.

Geon is a remarkable plastic raw material for flexible products like insulation, rigid products like pipe, sponge and foam products like floats and seat padding. Used as a coating, it contributes its durable, water- and chemical-resistant properties to other materials.

Let us suggest how you can benefit by using Geon polyvinyl materials. For new booklet write Dept. DS-8, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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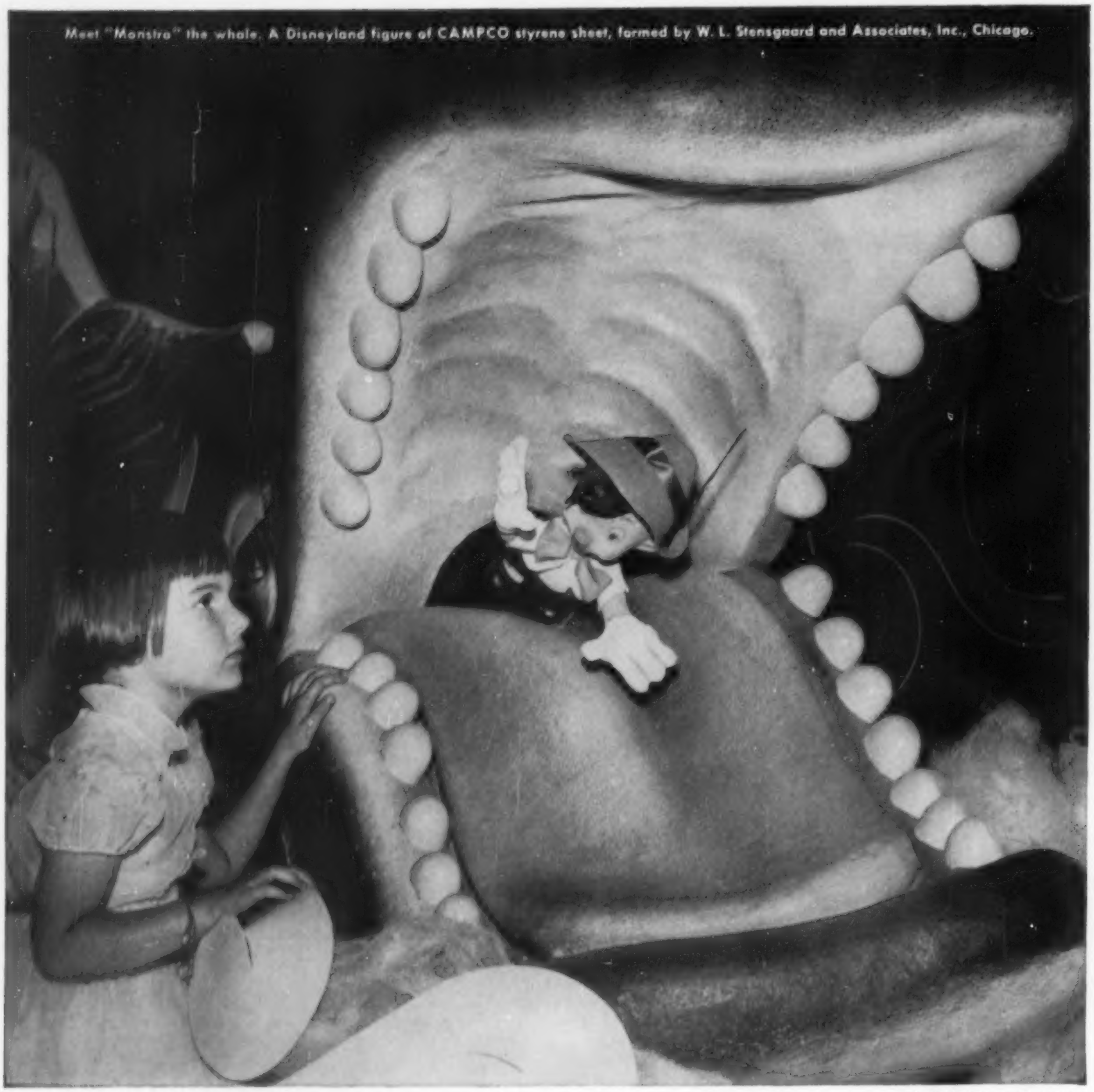

Meet "Monstro" the whale. A Disneyland figure of CAMPCO styrene sheet, formed by W. L. Stensgaard and Associates, Inc., Chicago.

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Editorial

Chaos in the premix market

The lead article in this issue, on polyester-fiber molding compounds, called "gunk" by some, "premix" by others, concerns a relatively new form of molding material which is already in a chaotic marketing situation.

The end-users of these materials will be largely in the automotive, electrical, electronic, home appliance, refrigeration, and industrial equipment fields. Runs will be long. Mistakes will be costly.

Major headaches faced by these end-users rest in the problem of writing and maintaining specifications, particularly on physical properties of the end product. Properties specified on data sheets or even indicated by test specimens often do not appear in molded parts and just as often vary widely over a production run.

The chief contributing reason for this is that many people are persuaded that the compounding of these materials is an easy do-it-yourself proposition. Many captive compounding operations, in end-user captive plants and in custom shops, involve small-batch compounding which magnifies the problem of batch-to-batch uniformity.

Another problem is created when tools are moved from one molder to another. Weeks may be wasted by trial-and-error development of a compound to match the specifications of the previous molder.

A very obvious solution to the whole problem is to use the proven data of the dozen major custom compounders and suppliers of reinforced molding materials as standards. These companies are specialists, with their whole livelihood dependent on their ability to produce for the open market materials which may be properly specified in writing and on which specifications may be maintained batch after batch, day after day.

Once a material is specified which can be purchased on the open market and on which data are available to all, then those who choose to compound their own mater[illegible] merely have to match these published properties. And if captive compounders would cost their materials into finished molded parts at the current price for comparable compounds purchased on the open market, they would be able to afford research and quality control so necessary to the proper exploitatio[illegible] of these new materials.

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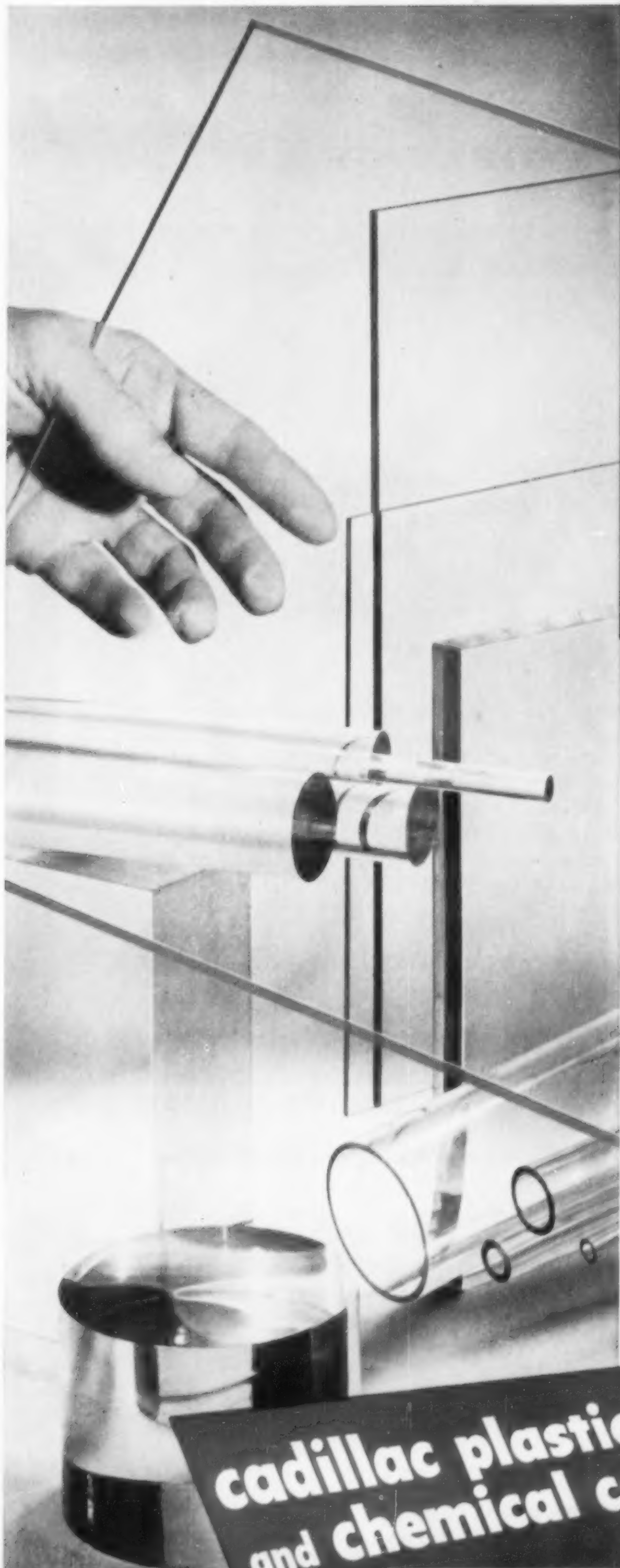

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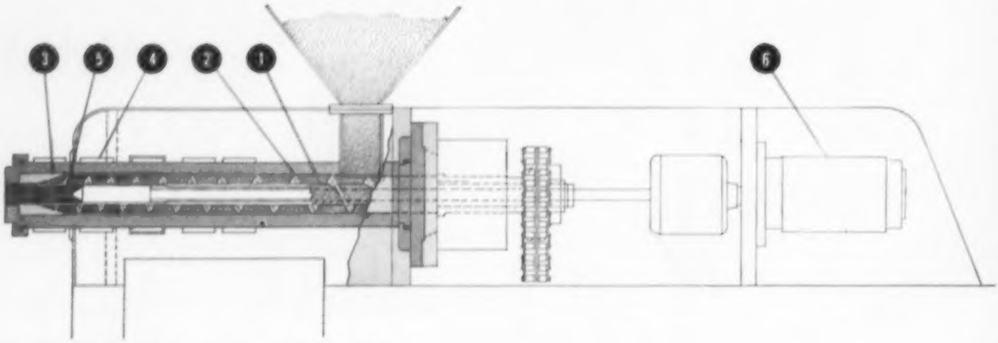

Here's How The *AUTOFLOW* Works:

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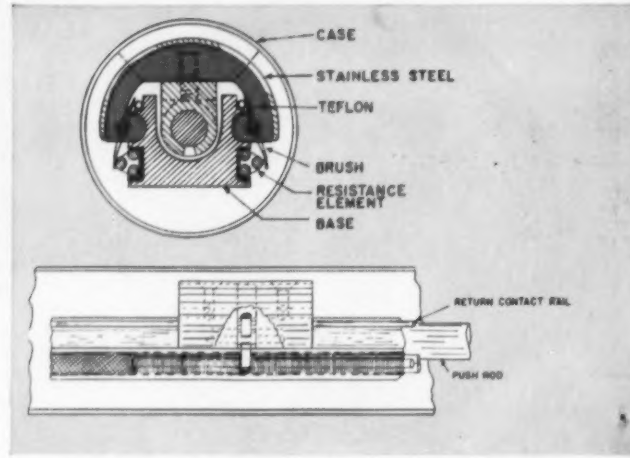
ALATHON for packages that are tough, but light in weight. These unbreakable, translucent, and re-usable containers increase sales for users.



TEFLON is used in many electrical and electronic applications. Its outstanding heat resistance made this miniature potentiometer possible.

LUCITE combines beauty with excellent durability in these attractive dispenser knobs. It has high impact strength, resists cracking, chipping and crazing.

4 more examples of

NEW WAYS are constantly being found to simplify design and reduce costs by replacing metal and other materials with Du Pont engineering resins. Shown here are four typical improvements made possible by an imaginative use of these versatile resins.

ALATHON® polyethylene resin is an ideal packaging material. It is lightweight, tough and flexible over a wide range of temperatures, has excellent chemical and water resistance, and is free from taste, odor and toxicity. Its chemical properties remain unchanged with age. Available from fabricators with a translucent texture or in a wide range of colors, ALATHON can be used as packaging material in the form of film, bottles and other containers, closures, liners for drums and multi-wall bags. (Containers and closures illustrated are made by Plastomatic Corp., Malvern, Pennsylvania).

LUCITE® acrylic resin is molded into these eye-catching dispenser knobs which serve as colorful point-of-sale reminders. LUCITE is especially suited to such decorative purposes. It is available clear or in a wide range of transparent and opaque colors. LUCITE has high impact strength and is shatter-resistant. Aging and moisture have little, if any, effect on LUCITE. It can be economically fabricated by several efficient techniques. (Knobs manufactured by Plastics Developments Inc., Attleboro, Massachusetts.)

TEFLON® tetrafluoroethylene resin has a wide range of applications in the electrical and electronic fields. Its excellent heat resistance and dielectric properties made possible the miniaturization of the potentiometer shown above. In this case, TEFLON operates at temperatures as high as 400°F. and gives intermittent service at 550°F. Its low coefficient of friction is also important in

ZYTEL replaces metal for conduit fittings on U.S. Navy aircraft carriers. Easily molded, rugged ZYTEL cuts weight and saves the Navy over $31,000 per carrier in this application.

advanced product engineering

this application since a sleeve must slide back and forth over the core. (Manufactured by the Pacific Scientific Co., Los Angeles, California.)

ZYTEL® nylon resin used as a replacement for metal in electrical conduit fittings, is helping the U. S. Navy save weight and reduce costs in aircraft-carrier design. Fittings molded of ZYTEL are 80% lighter than the metal parts replaced. Because of improved design, 9 sizes now do the job that used to require 27. Products molded of ZYTEL feature toughness, abrasion resistance, form stability at high temperatures, strength in thin sections, lightness in weight, and chemical resistance. (Fittings molded by Danielson Mfg. Co., Danielson, Connecticut.)

For further information on the properties and uses of these materials, use the coupon at right.

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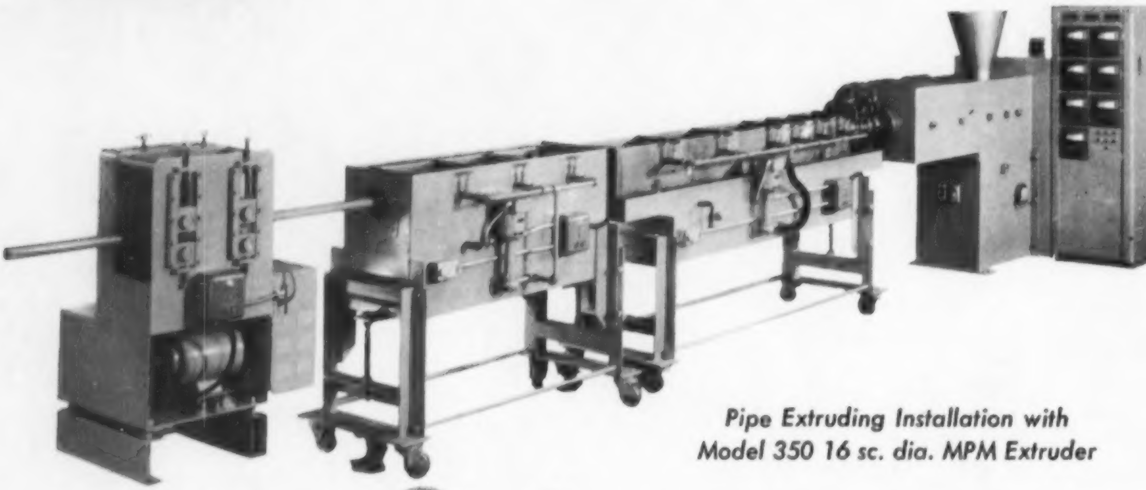

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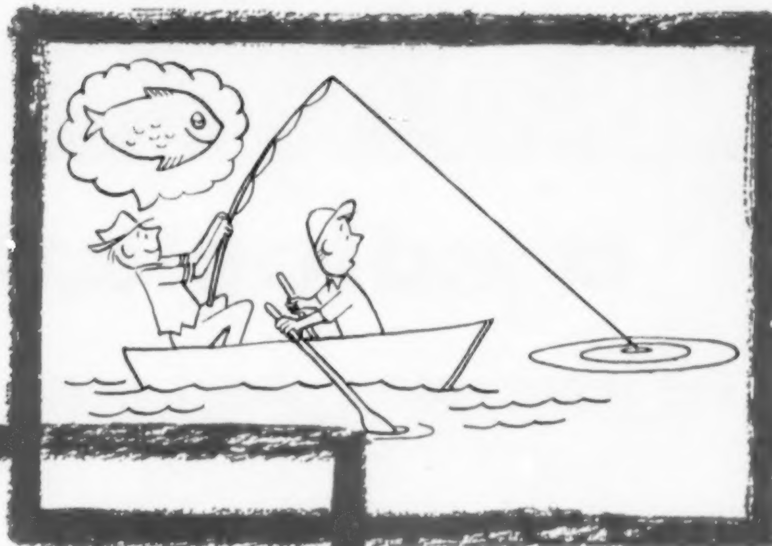

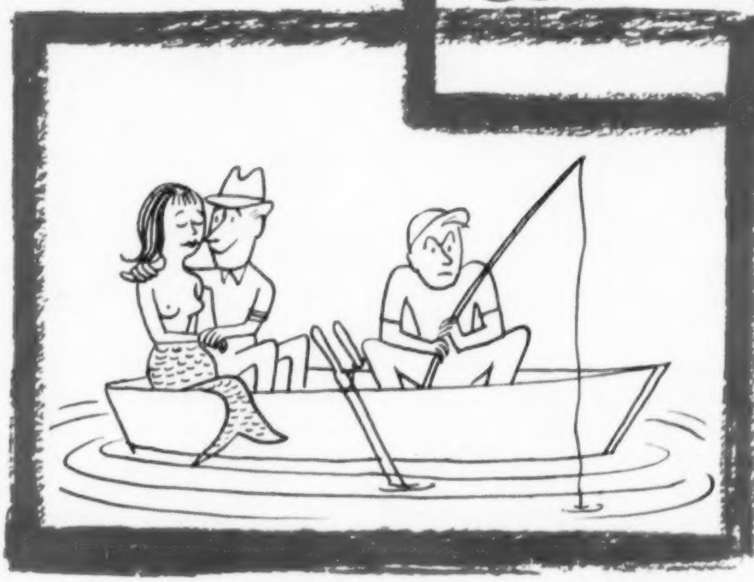

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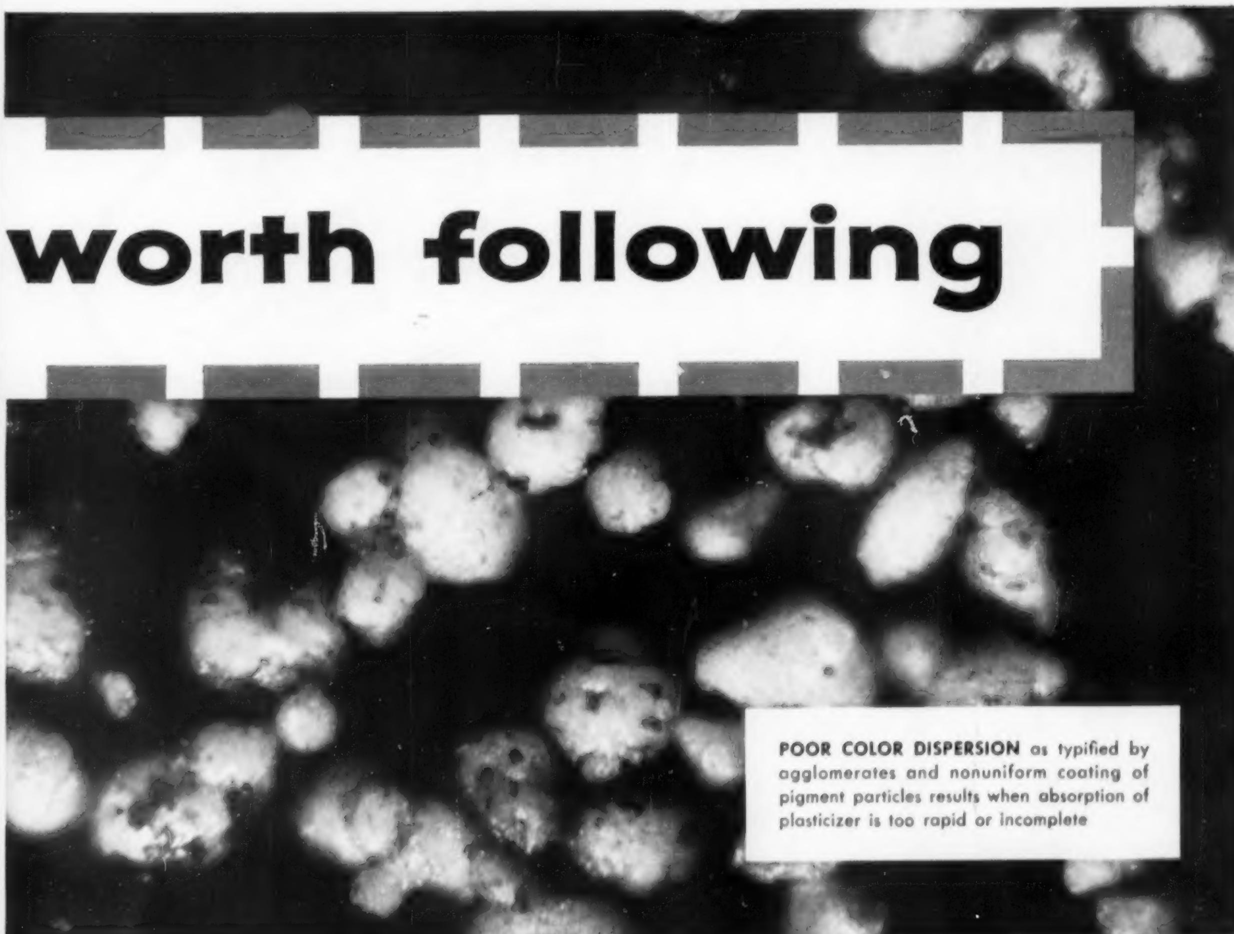

POOR COLOR DISPERSION as typified by agglomerates and nonuniform coating of pigment particles results when absorption of plasticizer is too rapid or incomplete

GOOD COLOR DISPERSION as indicated by uniform deposition of pigment on resin particles results from complete absorption of plasticizer

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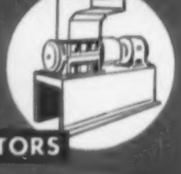

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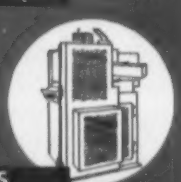

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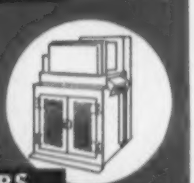

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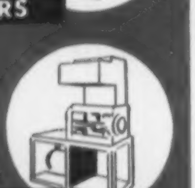

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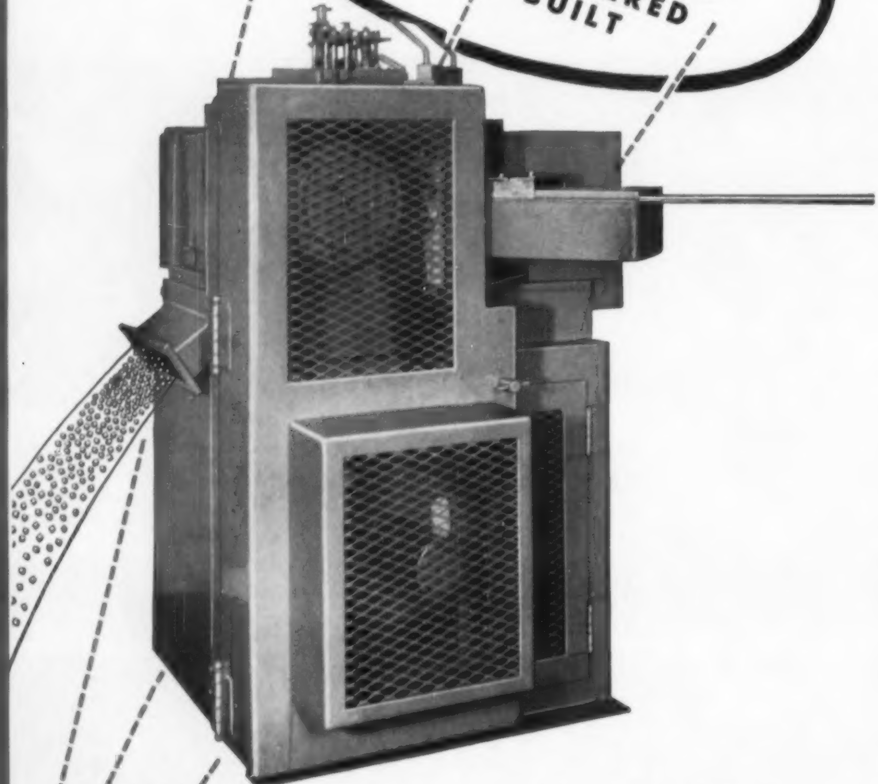

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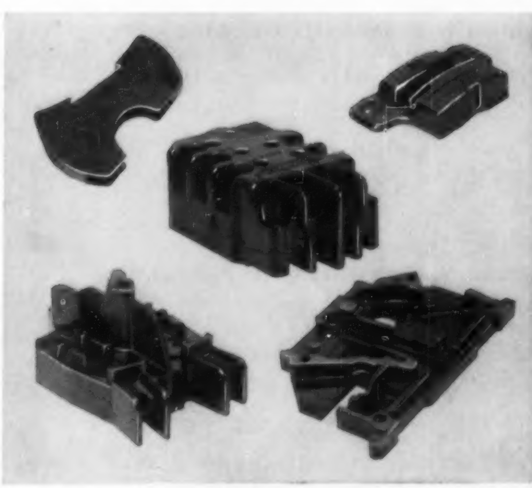

in **plastics** too... the easiest answer is to surround your problem with "know how" and then shape it to fit. Our Kanine Karrier (*above*) has the answer . . . so does Kurz-Kasch.

If your parts can be molded in one of the tried and true thermo-setting plastics or the newer fluorcarbons and glass-reinforced materials, flexible Kurz-Kasch can bend "know how" like a pretzel and come up with dependable custom-molding.

Name the service you need . . . designing, moldmaking, production runs . . . its all under one roof . . . at Kurz-Kasch.

And talk about pretzels . . . *here*, they bend over backwards to help straighten you out.

Let's talk over your thermosetting plastic problem . . . OK?

BRANCH SALES OFFICES

New York, Mt. Vernon	MO 4-4866
Rochester	Hillside 0626
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Beverly, Mass.	Telephone: 65

Help! Send your representative to our rescue. We have a thermosetting plastic problem.

name ____________________

title ____________________

company ____________________

address ____________________

city ______________ state ________

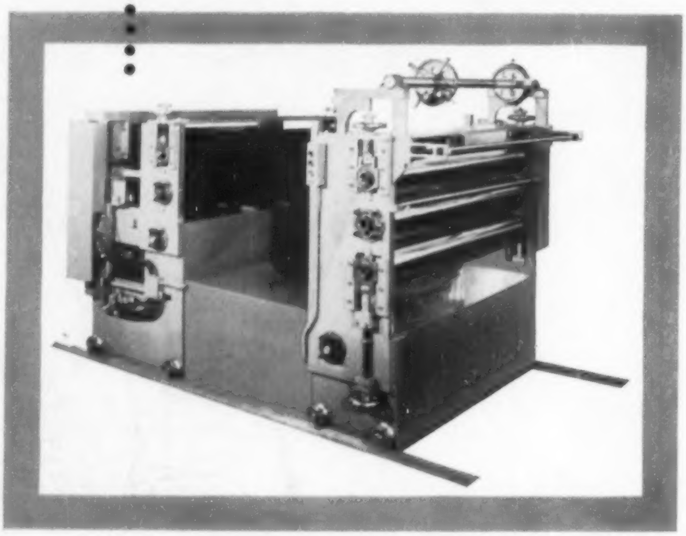
SPECIALISTS IN THERMO-SETTING PLASTICS FOR 40 YEARS.

kurz-kasch

1415 S. BROADWAY, DAYTON 1, OHIO

Robbins

creative thinking
plus
creative engineering
gives you the latest
in **package** *sheet*
haul-off equipment



ROBBINS HAUL-OFF UNIT AND SHEAR COMBINED . . .

This newest ROBBINS Combination is being used for production of top quality sheet and laminating. This combination mounts on base rails and comes equipped with the rails and ball-bearing rollers for easy movement. Either or both bottom and top chrome rolls can be made adjustable. Laminating rolls can be set in most practical position for any specific operation. Sub-Base can be furnished with unit so that you can feed through the bottom and middle roll. Variable speeds on all units. Used with other ROBBINS individual units or special attachments, this latest ROBBINS Combination has the flexibility to meet your requirements. Robbins dies and haul-off equipment can be used with practically all makes of extruders now on the market.

ANOTHER ROBBINS "FIRST"

★ The *first* with built-in self-contained air or hydraulic units for operation of shear.

★ The *first* with built-in temperature control units for heating of rolls.

Chrome Haul-Off Rolls—Rubber Pull Rolls
Traveling Automatic Shear—Automatic Scrap Cutting

Sheeting Dies • Stacking Units • Split Base Sheeting Units • Wind up Units • Profile Dies • Pipe Dies • Water Tanks • Pipe Pull-Offs • Pipe Coiling Machines • Automatic Cut-Off Saw Conveyors

Robbins
never say die . . . say Robbins die

PLASTIC MACHINERY CORP.

1430 MISHAWAKA STREET • • • ELKHART, INDIANA

Sheeting Dies A Specialty


there's an added ingredient
for you in Fostarene... production-line
testing by a molding pioneer
You can't help but benefit from the new and different approach to quality control and product development which produces Fostarene. New formulations are production-line tested in the maker's own molding operations—tested for strength... tested for brilliance ... tested for clarity... tested for practicability and economy. Investigate Fostarene...and discover the ultimate in polystyrene.
FOSTARENE
VIRGIN POLYSTYRENE · general-purpose · high impact · high flow
AVAILABLE IN PELLETS, GRANULES AND FINE GRIND FOR DRY COLORING ... IN CRYSTAL CLEAR AND A FULL RANGE OF CUSTOM COLORS
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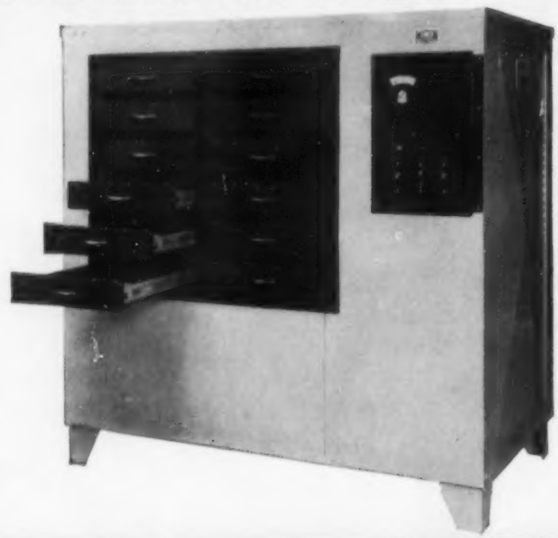
MANUFACTURED BY: FOSTER GRANT CO., INC., PETROCHEMICAL DIVISION
MONOMER PLANT, BATON ROUGE, LA. • POLYMERIZATION PLANT, LEOMINSTER, MASS.
A PIONEER IN PLASTICS FOR OVER THIRTY YEARS

INJECTION MOLDERS!

BOOST PRODUCTION!

SPECIAL IMS NYLON DRYING OVEN



NYLON SPECIALTIES

BUILT-IN DEHUMIDIFIER

Sealing Drawers! ½ HP Fan! 10 KW Heat for Quick Recovery: The Only Oven Built Expressly for All Thermoplastic Work. Price Complete for 220-volt Operation $1638.50

SPECIAL IMS NYLON ANNEALING TANKS

5 Gal. $210.60
10 Gal. $284.50
25 Gal. $464.00

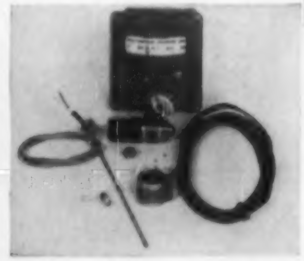
Bottom Drain—Side Heat Only—Based on Dupont Suggestions for Safe Use of Hitec Salt or Wax

IMS NYLON NOZZLE KITS

WITH NOZZLES BASED ON DUPONT SUGGESTIONS

MODEL A— with Variac Control

Price, complete with 1¾"—8 thread, 5" nozzle, 3/16" orifice, ½" or ¾" radius nozzle. $176.00



MODEL C— with Pyrometer

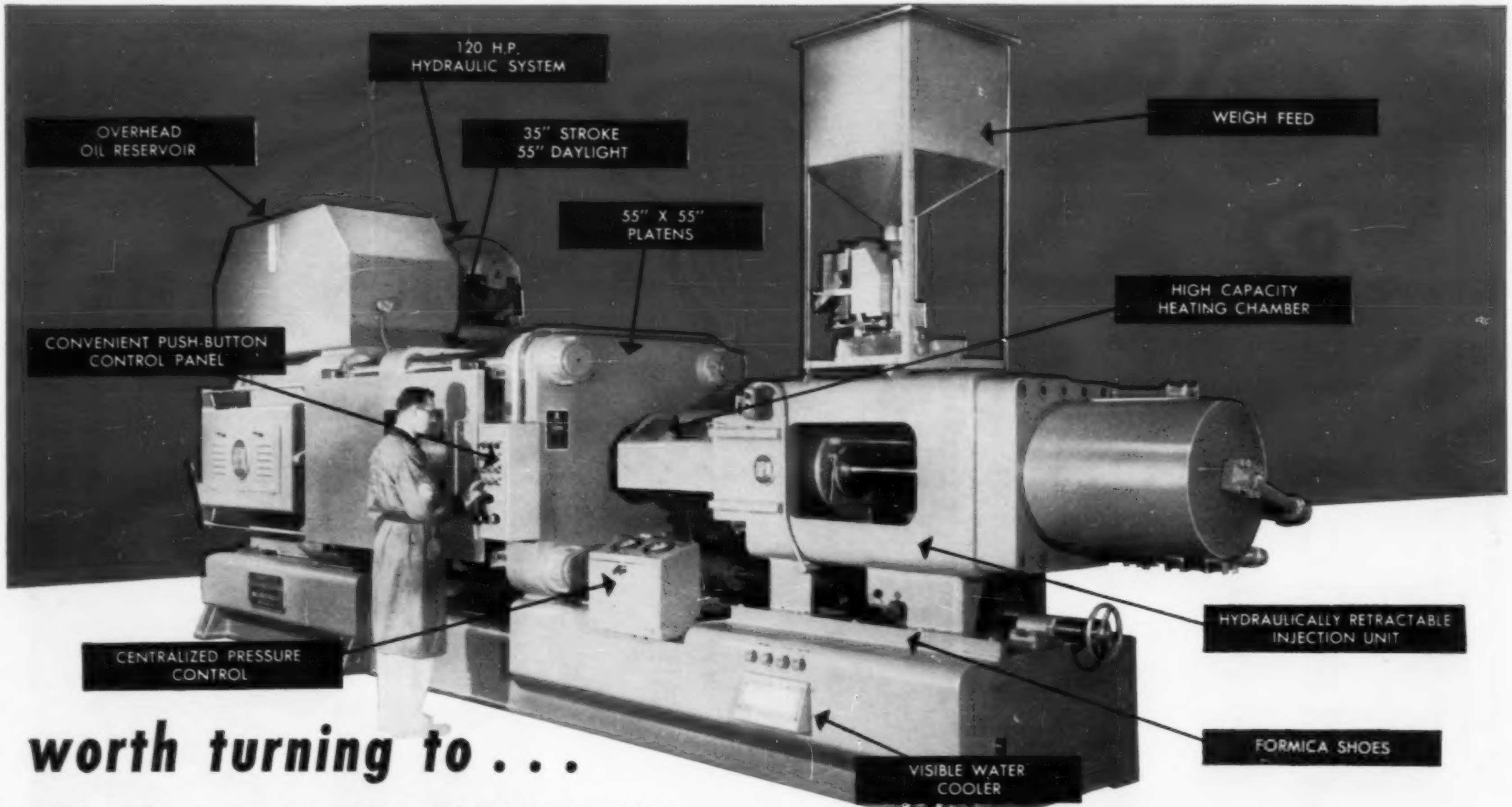
Price complete as shown with 1¾"—8 thread nozzle 3/16" orifice, ½" or ¾" radius $410.50

Write for prices on other nozzle types.

Send for our 1956 Nozzle Catalog today. You'll find all styles of nylon nozzles described and priced on pages 32-35—with technical notes on nylon molding. Prompt service on all kinds of nozzles by the world's largest and most experienced nozzle specialists.

INJECTION MOLDERS SUPPLY CO.

3514 LEE ROAD, WYoming 1-1424
CLEVELAND 20, OHIO



worth turning to . . .

With its wide acceptance in the field, the H-P-M 48/64 oz. machine has proven that it was designed to meet molders' specifications . . . high capacity plasticizing chamber . . . weigh feeder . . . greater "shot" capacity . . . plenty daylight and stroke . . . quiet pumps . . . subplate mounted valves reducing piping to a minimum . . . actually so many new features that only a few of the important ones are brought to your attention here. Check these features carefully . . . they mean bigger profits for any molding shop.

H-P-M injection machines are available in sizes from 6 to 400 oz. with mold clamping forces from 150 to 3000 tons. Write for Bulletin 5601 today.

Write for Bulletin 5601 Today!

HPM

PLASTICS DIVISION
THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U.S.A.

MANUFACTURERS and FABRICATORS of Acrylics, Ureas, Fabric and Paper Base Phenolics, Polystyrenes, P.V.C., Fibres, Butyrates, Printed Circuitry and High Pressure Laminates USE and RECOMMEND...

Radialloy-Tipped*

Circular Saw Blades

Fine chip-free cuts · Close tolerances

Long blade life · Smooth edges · Economy

These skillfully designed, durably constructed Radialloy-Tipped Circular Saw Blades provide optimum production efficiency. They actually *boost* production profits higher—they operate *faster, smoother* and they are available for *close tolerance* work to suit your application problem, thus eliminating costly and wasteful trial and error methods.

This Saw Blade Is Really Different, Far Superior! Super-Finishing is the reason why these blades provide *higher performance* and *operating economy.* They do not vibrate when used on typical "tough sawing" materials such as plastics and plastic laminates. Why? *There's no variation in tooth construction!* They're engineered from the heat-treated shank out as carbide blades—*they are not* regular saws with carbide tips added!

And we are ready to prove their superiority! We'll gladly furnish sample cuts of your materials to illustrate the smooth edged, chip-free, close tolerance cut obtained with these saws.

WRITE for prices and brochure on our complete line.

Radialloy-tipped SUPER-FINISHED SAWS & CUTTERS

RADIAL CUTTER MANUFACTURING CORPORATION

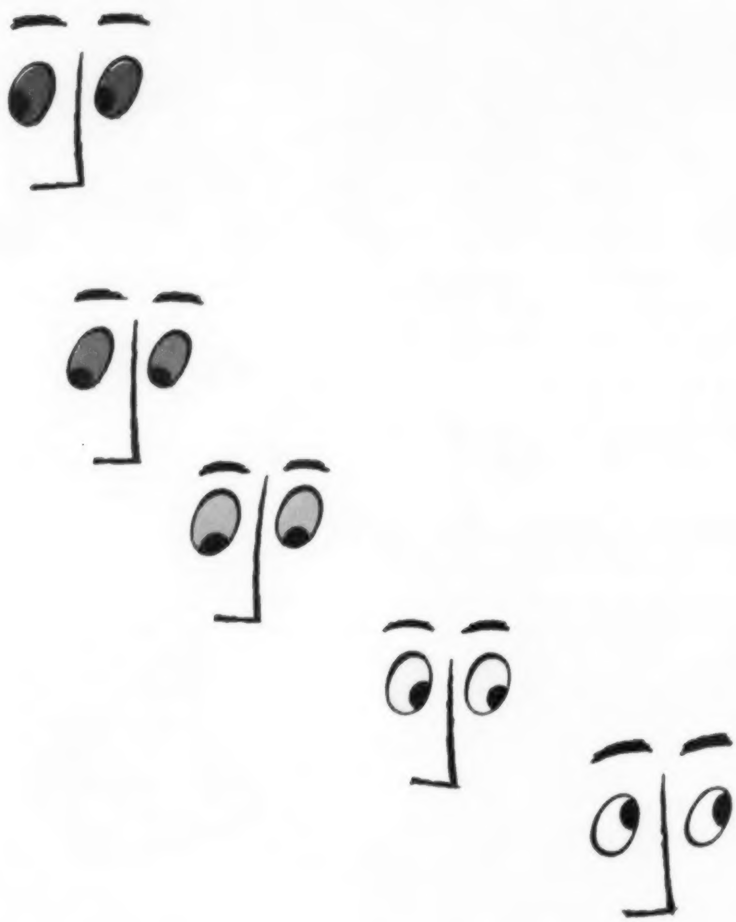
835 Bond Street, Elizabeth 4, New Jersey

SPECIALISTS AND LEADING MANUFACTURER OF CARBIDE-TIPPED SAW BLADES

*Reg. U. S. Pat. Off.

The show is over... and you can still count on

Plenco



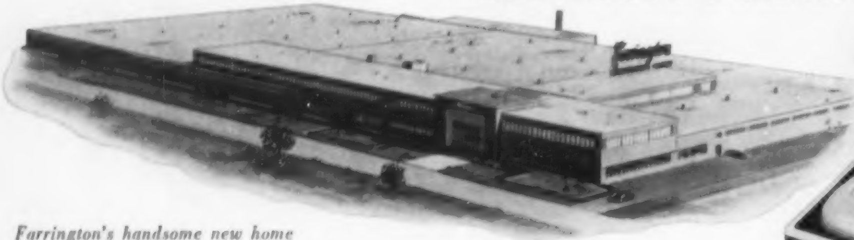
PLENCO PHENOLICS
FOR BETTER PLASTIC PRODUCTS

PLASTICS ENGINEERING COMPANY
Sheboygan, Wisconsin

It was good to see so many of our old friends at the show, and to meet so many new ones. We hope to see you again soon. You'll certainly be hearing from us.

Serving the plastics industry in the manufacture of high grade phenolic compounds, industrial resins, and coating resins.

Angier Adhesives bond Plastic to Metal at *Farrington*® of Boston for these Famous Names



Farrington's handsome new home at the New England Industrial Center, Needham Heights, Massachusetts.

REMINGTON

Fame came first to our Farrington friends when they applied their automatic spring hinge to a metal case with snap cover for spectacles. That was back in 1904.

Since then "*Packaged by Farrington*" has become a mark of distinction in display cases for watches, jewelry, fountain pens, electric shavers, playing cards, and many other quality products.

As part of their rigid quality control, Farrington selects an Angier Adhesive for the sure bonding of their Texol®* simulated leather to thin sheet steel. Some of the famous products given added sales appeal by this packaging technique are shown here.

**Farrington's trade-marked name for its own simulated leather.*

SHEAFFER'S

GRUEN

Consult an Angier man early with your bonding problem. He represents twenty-five years of custom service for every adhesive need.

Write Dept. A for Free Descriptive Brochure

SWANK

ANGIER ADHESIVES

For Every Industry

Latest developments in Adhesives for
Honeycomb Construction, Vinyl Film Bonding
Rubber, Latex and Resin Cements
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Tie Coats   Resin Emulsions

Angier Adhesives

Division of Interchemical Corporation
120 POTTER STREET, CAMBRIDGE 42, MASS.

Midwestern Plant: Huntington, Indiana

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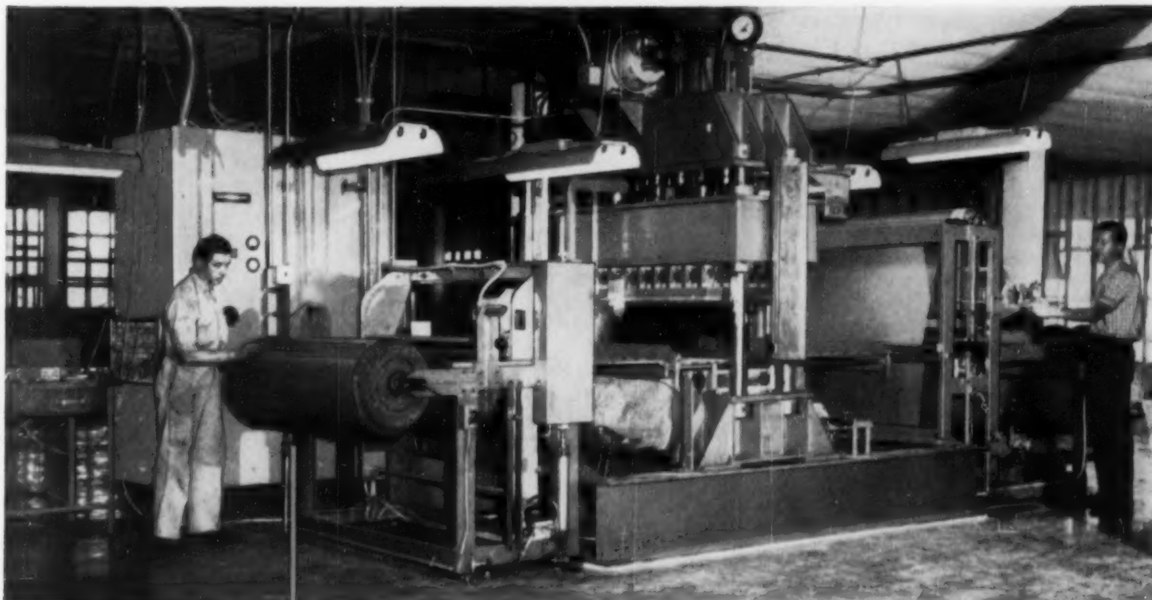
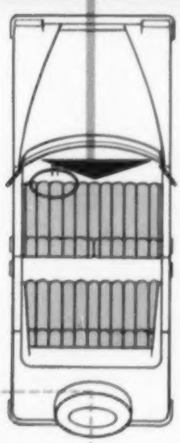


At the Masland Duraleather plant in Philadelphia, sheets of Masland Duran vinyl plastic are electronically welded to a backing, producing a handsome quilted upholstery fabric for automobiles and other uses. The work is done by a large, completely automated Thermatron press in conjunction with a Thermatron generator and indexer. Full rolls of plastic are fed into the press, quilted and rewound in one continuous operation with only supervisory operators.

America's newest cars owe so much to plastics welded by

Thermatron®

HIGH FREQUENCY SEALING AND HEATING EQUIPMENT



Electronically welded plastic products for the automotive industry include . . .

- Door panels
- Upholstered seats
- Safety cushioning
- Convertible tops
- Reservoir bags for windshield wipers
- Interior head linings
- Visor pouches
- Tool kits
- Carburetor filters

You've admired that attractive upholstery in many new cars. It's vinyl plastic, weld-quilted by Thermatron equipment. Then there's the safety cushioning of the sun visors and dashboards. Thermatron does that too—welds and shapes the foam filled visor for more shock resistance.

Because of Thermatron, plastics have become an important part of modern automobile design, and the applications are unlimited. If *you* have a new plastic product in mind, our engineers will be glad to run tests on your own material and make suggestions. Write today to Dept. 107.

Radio and Electronic Products Since 1922

R&R

Thermatron Division

RADIO RECEPTOR COMPANY, INC.

SALES OFFICES: 251 West 19th St., New York 11, N. Y. *Telephone:* WAtkins 4-3633
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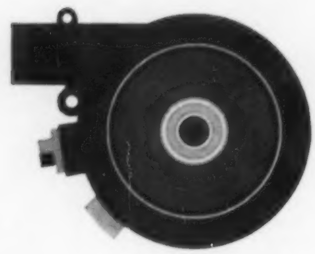
FACTORIES IN BROOKLYN, N. Y.

DO YOU USE FABRICATED METAL PARTS? .. VOLUME GOING UP?



.. this chart shows how Richardson molded parts can reduce production costs (example: a water pump housing):

Year	Production Method	Total Annual Quantity	Total Cost	Unit Cost
1st year	fabricated metal	3,600 pump housings	labor and material $7,200.00	$2.00
2nd year	molded plastics	now increased to 12,000 pump housings	plastic mold ..... $8,000.00 12,000 housings purchased from Richardson 9,000.00 $17,000.00	$1.42
3rd year	molded plastics	same quantity—12,000 pump housings	mold (charged off on previous year's production—still good for hundreds-of-thousands of parts) ..... — 12,000 housings purchased from Richardson $9,000.00 $9,000.00	only 75c

Molded parts also offer these advantages:

.. smooth, attractive surface!

.. no painting necessary—plastic is rustproof!

.. save assembly time—inserts mold in!

.. plastic reduces noise and insulates against heat!

Richardson engineers are available to assist you in determining molding costs. Working with your own engineers, they can cooperate in the development of new designs for improved performance, better appearance, and reduced production costs .. experienced tool and diemakers, working in one of industry's largest tool and die shops, can produce long-lasting molds accurately. Write or phone today—Chicago, MAnsfield 6-8900. The Richardson Company, 2789 Lake St., Melrose Park, Illinois (Chicago area).

RICHARDSON PLASTICS MOLDED AND LAMINATED


HERCULES
hi-lites
on hi-fax
and other Hercules plastics
over
Hi-fax for better housewares—from mixing bowls
to baby bottles; spoons to canisters; pitchers to glasses
. . . Hi-fax, a versatile new ethylene polymer to be made
by the Hercules process, will mean better products
for tomorrow's market. For more information on Hi-fax,
and other new Hercules plastics developments, turn the page.
HERCULES POWDER COMPANY

hi-fax for better housewares

Hi-fax, the new ethylene polymer to be made by the Hercules process, brings a new range of exciting properties to housewares. A completely new plastic, Hi-fax offers a combination of unique properties never before available.

Here's what Hi-fax brings to housewares:

Hi-fax can be sterilized! Products made with Hi-fax can be immersed in boiling water without distortion.

Hi-fax is four times as rigid! Provides four to five times the rigidity of regular polyethylene.

Hi-fax is twice as strong! Has double the strength of conventional polyethylene.

Hi-fax has improved resistance to solvents and greases! Has a fluid permeability of only ⅕ that of regular polyethylene.

All this plus: a richly colorful, lustrous finish. Easy to mold or fabricate by conventional methods.

That's why: People who have seen Hi-fax agree it's the plastic of tomorrow for tomorrow's superior products. Whether you make or design toys, housewares, industrial moldings, sheet and film, pipe, bottles, or electrical insulation, you'll want to learn more about how Hi-fax can improve existing products or help launch new ones.

Cellulose Products Department

HERCULES POWDER COMPANY
INCORPORATED

916 Market St., Wilmington 99, Del.

CP56-3

HERCULES

HI-LITE ON

hercocel®

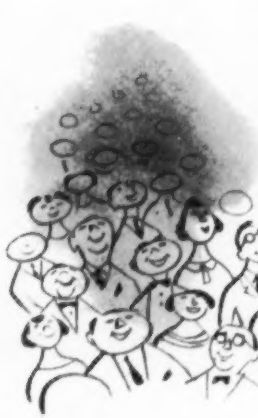
Hercocel — Hercules® cellulose acetate — another member of the growing Hercules plastics family, keeps products on the move in design, production, and sales. The General Electric Portable Mixer is typical of the products that take advantage of this versatile material. Its flame-resistant housing, beautifully styled for the modern kitchen, is lightweight but strong, chip proof and stain-resistant — an example of the many products today that rely on economical, easy-to-mold Hercocel.

In molding, too, it's all in knowing HOW!

Steady, young man!

The people watch, thrilled and admiring. How does he *do* it? Well, here's an explanation that you, interested in plastics, should understand. Let's consider Boonton.

For more than 34 years, Boonton has been pleasing customers by producing custom injection and compression moldings of superb quality at low, sensible prices. And, like the daring fellow on the wire, Boonton has that professional knack of doing a difficult job so smoothly, it seems simple. However, there's never any "fiddling around" when Boonton is doing a job. No, sir! Every job moves briskly along, right from design phase to final delivery.



Summing it all up, we figure there are three words that tell, simply and neatly, why Mr. Acrobat and Boonton are both such crowd pleasers: skill and experience. And the wonderful part is that these extraordinary advantages are yours at very ordinary prices. Call and find out for yourself.

BMCO

BOONTON MOLDING CO.

BOONTON, NEW JERSEY

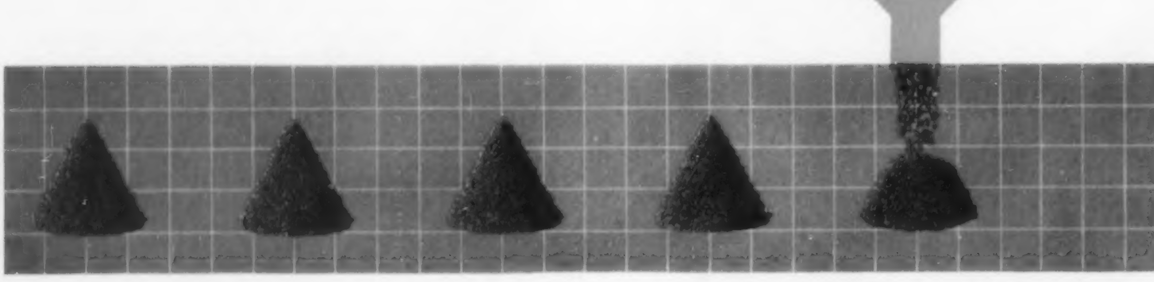
NEW YORK OFFICE—CHANIN BUILDING, 122 EAST 42ND STREET, OXFORD 7-0155

Rogers impact phenolics quality-controlled

FOR AUTOMATIC LOADING

Rogers medium and medium high impact phenolics for automatic molding are the result of a development program with manufacturers of automatic molding equipment. Produced under rigid statistical quality control methods, these compounds feature consistent uniformity in pourability and are so clean as to be virtually dust-free. These advantages are coupled with a fast rate of cure, a low bulk factor of 3.5 to 1 and good to excellent molded appearance.

Uniform apparent density of Rogers impact phenolics for automatic molding assures the right charge every time for automatic volumetric loading or preforming. Absence of dust eliminates arcing during pre-heating. Although created for automatic molding, these Rogers materials offer many advantages for conventional molding techniques. *Write to Dept. P for data sheets or ask to have one of our technical representatives review our materials program with you.*



Material ideas for product improvement

Better Parts for Better Products

ROGERS CORPORATION

ROGERS, CONNECTICUT

PRODUCTS

DUROIDS—for Gaskets, Filters, Electronic Devices, etc. ELECTRICAL INSULATION—for Motors, Transformers, Generators, etc.
SHOE MATERIALS—for Counters, Midsoles, Liners, etc. PLASTICS—Special Purpose Molding Compounds and Laminates.

SERVICES

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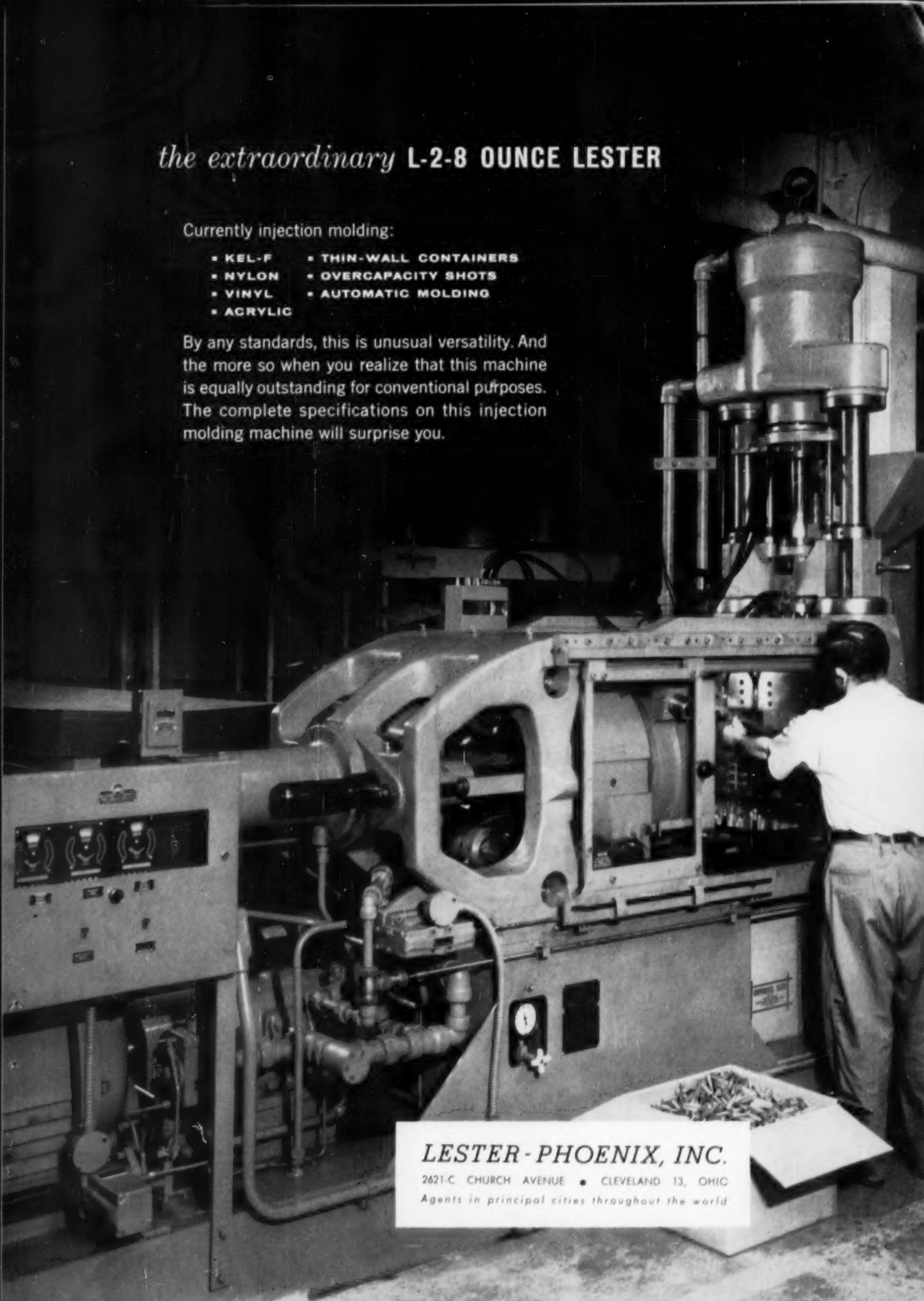
the extraordinary L-2-8 OUNCE LESTER
Currently injection molding:
• KEL-F
• NYLON
• VINYL
• ACRYLIC
• THIN-WALL CONTAINERS
• OVERCAPACITY SHOTS
• AUTOMATIC MOLDING
By any standards, this is unusual versatility. And the more so when you realize that this machine is equally outstanding for conventional purposes. The complete specifications on this injection molding machine will surprise you.
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Agents in principal cities throughout the world

MOULDED PARTS
WEAK AND
BRITTLE?

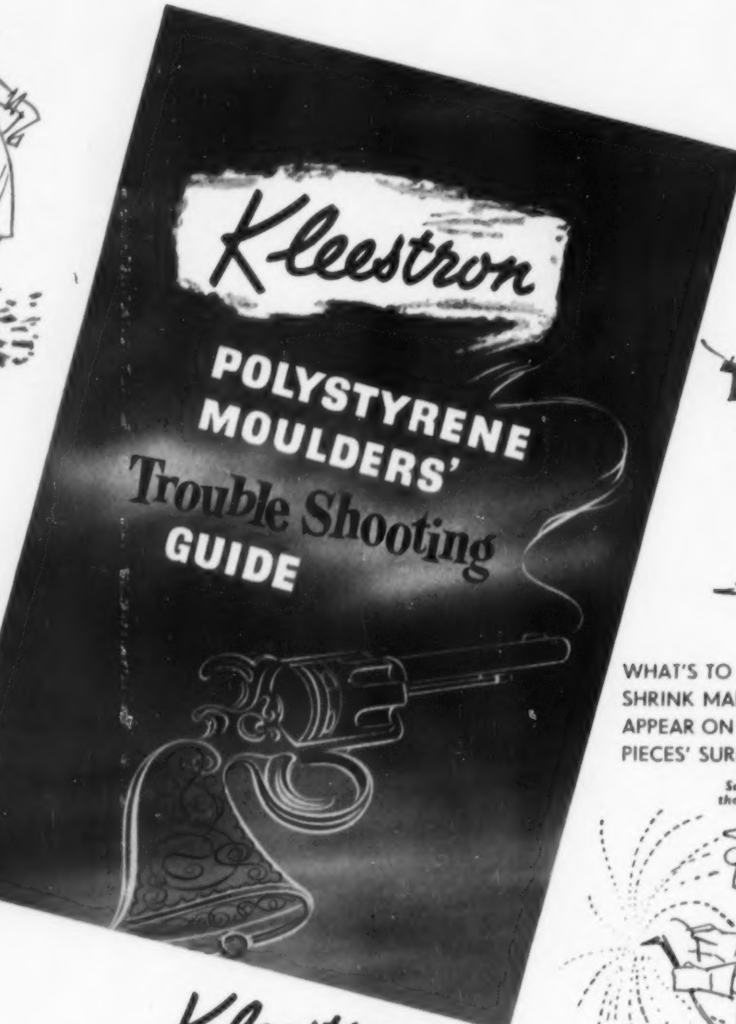
See Section 13 for remedies

HAVING TROUBLE
WITH HEAVY
SECTIONS?

See Section 16 for advice on this

HOW'S ONE TO PREVENT
SPRUE STICKING?

See Section 4 for the solution



WHAT'S TO DO WHEN
SHRINK MARKS
APPEAR ON MOULDED
PIECES' SURFACES?

See Section 6 for the answer to this

WELDING PROVING
A PROBLEM?

See Section 11 for seven possible solutions

Kleestron

PROVIDES THE ANSWERS

Yes—here in Kleestron's newest aid to plastics people are the answers to those problems met with in moulding shops. Prepared by Kleestron researchers the Trouble-Shooting Guide (tabulated for easy reading) lists a total of over 250 faults and remedies. Cause, effect and necessary action are all dealt with. It's a booklet that no moulding shop should be without; and it's absolutely FREE. Make sure of *your* copy of Kleestron's POLYSTYRENE MOULDERS' TROUBLE-SHOOTING GUIDE. Write, phone or call today!

Kleestron *Manufacturers of*

Kleestron H469 — high impact polystyrene in extruded or dry colourant pellets
Kleestron Crystal 684 — dry colourant blend
Kleestron Crystal 467 — extruded pellets
Kleestron Standard Colour Range — samples on request
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PERFECT DRY BLENDING

— by the pound or carload!

Low cost laboratory ThoroBlender has working capacity of .3 cu. ft.

the Patterson ThoroBlender

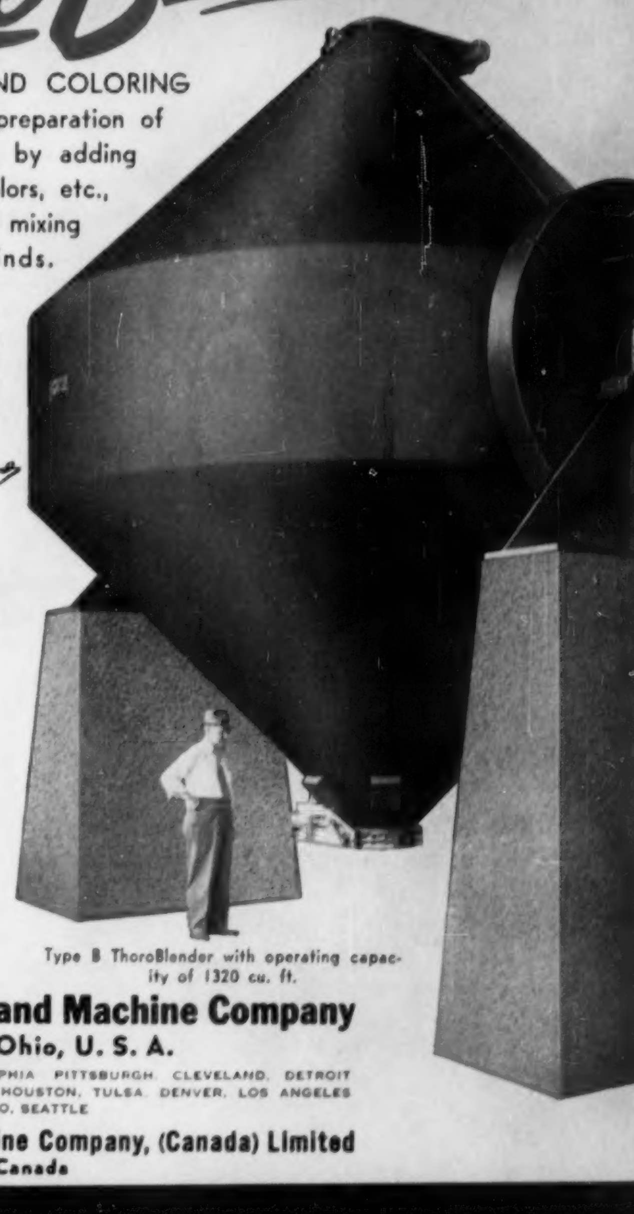
FOR COATING AND COLORING OF PLASTICS—for preparation of moulding compounds by adding fillers, plasticizers, colors, etc., and for blending and mixing operations of all kinds.

Each revolution of the Patterson ThoroBlender carries the batch a measured step toward homogeneity—reaching the goal in remarkably short running time. Write for detailed Bulletin No. 559.

Richard L. [illegible]
President

A HOMOGENEOUS BLEND IN MINUTES!

A CARLOAD PER BATCH! That's the capacity of this 16 ft. ThoroBlender—used for homogenizing various batches of plastics—every batch perfectly blended and ready to package. No waiting for a slow blender.



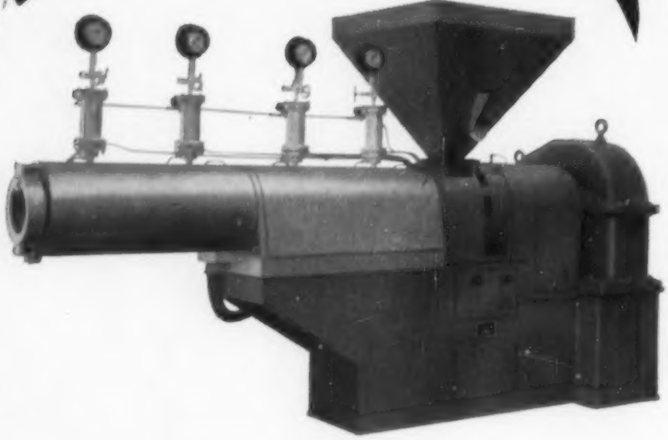
Type B ThoroBlender with operating capacity of 1320 cu. ft.

The Patterson Foundry and Machine Company
East Liverpool, Ohio, U. S. A.

NEW YORK, BOSTON, BALTIMORE, PHILADELPHIA, PITTSBURGH, CLEVELAND, DETROIT, CINCINNATI, ATLANTA, CHICAGO, ST. LOUIS, HOUSTON, TULSA, DENVER, LOS ANGELES, SAN FRANCISCO, SEATTLE

The Patterson Foundry and Machine Company, (Canada) Limited
Toronto, Canada

Egan EXTRUDERS



"WILLERT VAPOR PRESSURE COOLING"*

This *Egan* designed system automatically eliminates problems of overheating due to excessive frictional heat. It is completely automatic—No moving parts—No need for operator to determine whether cooling should be "on" or "off"

*Patent applied for

another Egan first

Standard *Egan* extruders for thermoplastics, in production use throughout the free world, have been designed for maximum flexibility and incorporate all the features important in extruder design.

Available with or without "Willert Vapor Pressure Cooling"* in all sizes from 2" to 8" • Screw lengths 16:1 or 20:1 • Hard corrosion resistant liners • Heavy duty thrust and radial bearings, force feed lubrication • Completely prewired temperature control cabinet • Screw speed tachometer • Precision ground screws Large feed hoppers with sight glass and cut-off slide Complete installations for film, sheet, pipe or shapes.

*Patent applied for

Egan
FRANK W. EGAN & CO.

Write, or phone RAndolph 2-0200 today for complete information—no obligation.

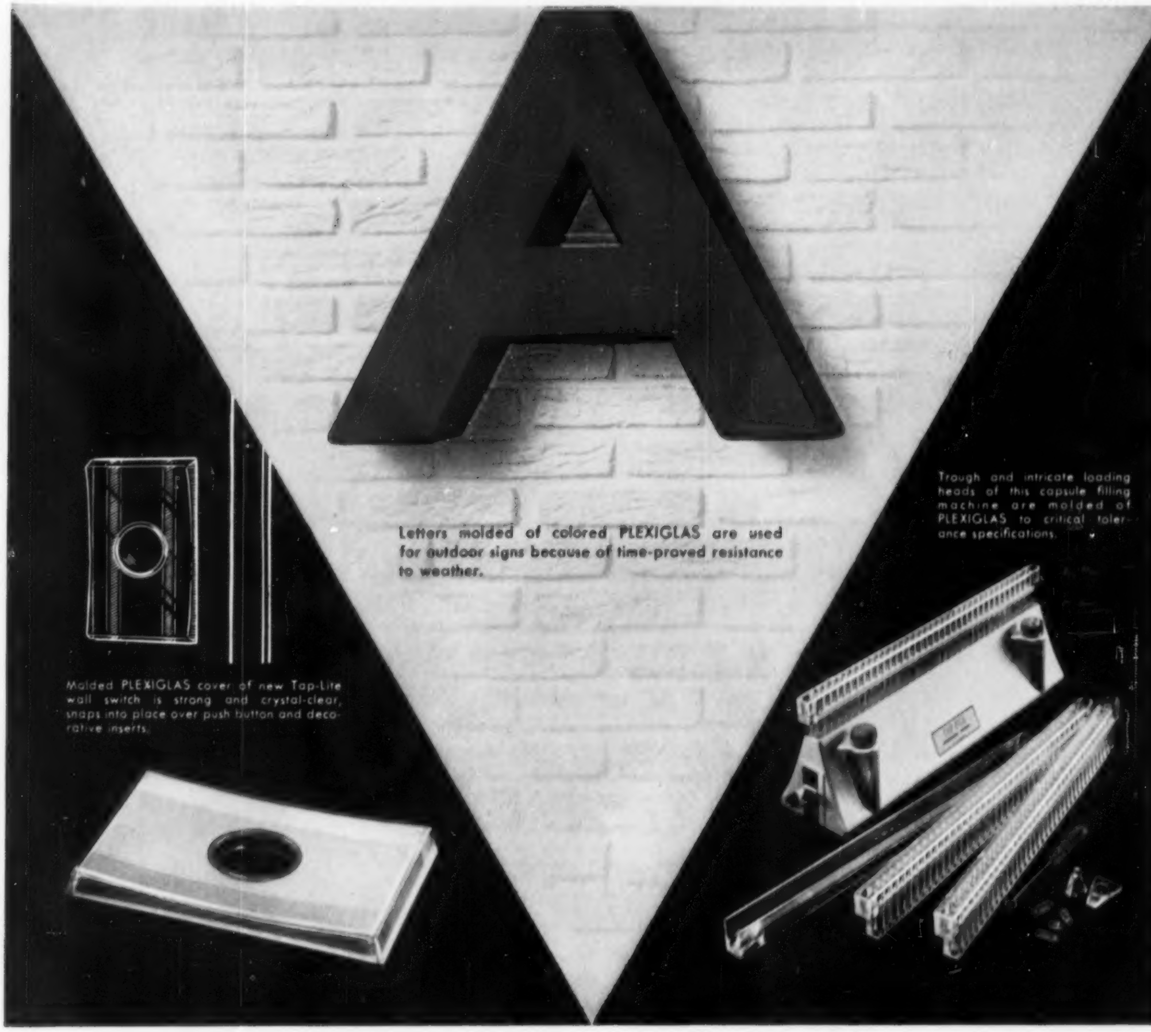
FRANK W. EGAN & COMPANY, Somerville, New Jersey

Designers and Builders of Machinery for the Paper Converting and Plastics Industries

Cable Address: "EGANCO"— Somerville, Njer.

Representative: MEXICO, D. F. — M. H. Gottfried, Avenida 16 De Septiembre, No. 10.

Licensees: GREAT BRITAIN — Bone Bros. Ltd., Wembley, Middlesex. FRANCE — Achard-Picard, Remy & Cie, 36 Rue d'Enghien Xe, Paris. ITALY— Emanuel & Ing. Leo Campagnano, Via Borromei I B/7, Milano. GERMANY— ER-WE-PA, Erkrath, bei Dusseldorf.



designed with PLEXIGLAS in mind

Shown above are just a few of the widely varying uses to which PLEXIGLAS acrylic plastic molding powder is being put today. Whether an application calls for rugged durability or gleaming beauty, or both, more and more designers and molders are finding that PLEXIGLAS is the material to use for best results. Here is the combination of advantages it offers:

- resistance to weather, breakage, heat, discoloration.
- ability to be molded accurately into complex shapes.
- brilliant colors, or water-white transparency that gives depth and sparkle to back-surface paints and metallized coatings.
- optical properties that make possible new designs in lighted moldings.

Our technical representatives and Design Laboratory staff would like to show you how PLEXIGLAS can solve specific problems involving molded plastic parts.

Chemicals for Industry

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

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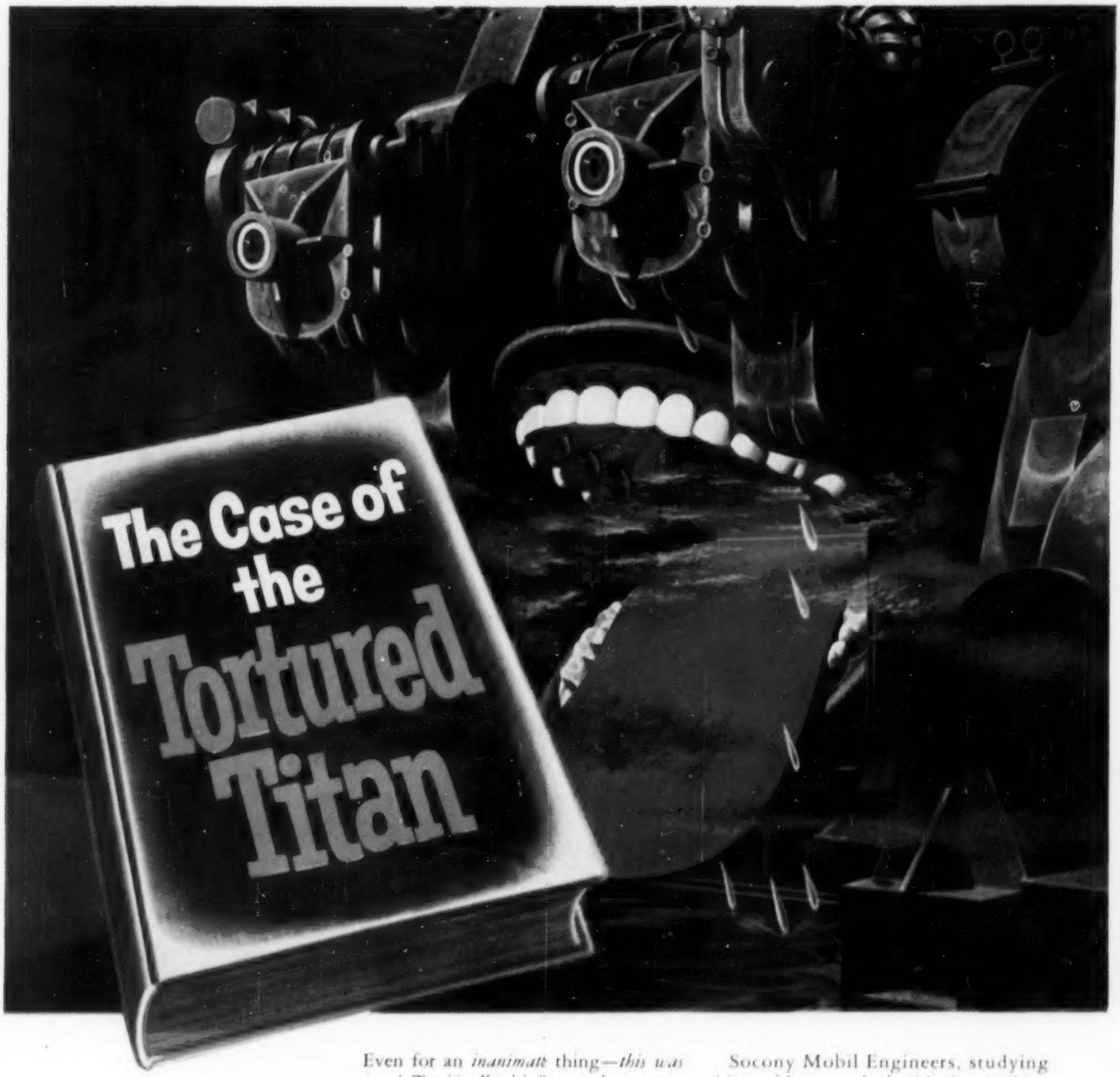

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Even for an *inanimate* thing—*this was torture!* Terrifically high speeds—pressures up to 60 tons—temperatures to 350°F. were turning this "titan" of a machine into a costly problem child!

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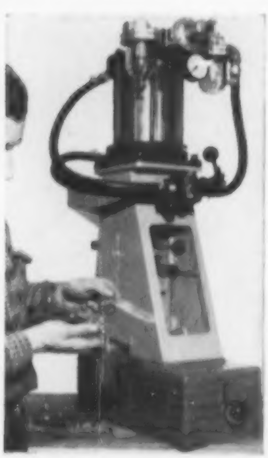

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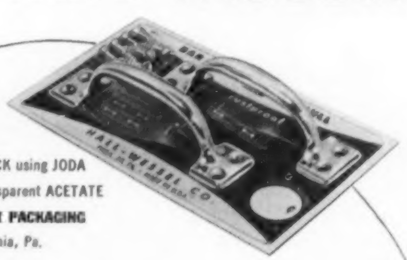

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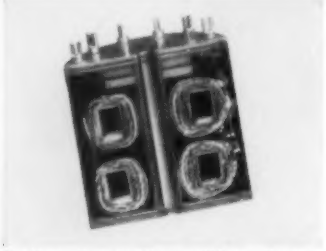
Miniature electronic components potted in Epon resin by Freed Transformer Company, Brooklyn, New York.


Section of magnetic amplifier coils embedded in Epon resin by Westinghouse Electric Corporation, Pittsburgh, Pennsylvania.


Potting transformer with Epon resin at PCA Electronics, Inc., Santa Monica, California.

Because of their excellent mechanical and dielectric properties, Epon resins are important materials in electrical and electronic manufacture. Epon resins combine high strength with low shrinkage on curing and extreme dimensional stability.

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The Plastiscope*

August 1956

News and interpretations of the news

By R. L. Van Boskirk

Section 1

Industry has a peek at polypropylene. The first public showing of polypropylene in the U. S. was recently made by the Italian firm of Montecatini at a press conference in New York City. As mentioned several times in Modern Plastics Magazine, polypropylene is one of the polyolefins which are polymerized at low pressure by recently discovered new catalysts. Conventional polyethylene (also a polyolefin) requires that extremely high pressures be used in the manufacturing process.

The polypropylene products exhibited at the press conference were molded containers, film, and monofilament. The containers were soft, but strong; the material had a somewhat rubbery feel without the waxy surface characteristic of polyethylene. The film was apparently there to prove that film could be made from propylene; it was admitted that development work on film is far from completed. Particular emphasis was placed on the strength of the monofilament or fiber. It is stronger than nylon and may turn out to be the finest of all polypropylene applications. Chief advantages stressed were heat and chemical resistance. Both are claimed to be considerably higher even than the Ziegler and Phillips types of low-pressure polyethylene. The Montecatini polypropylene was *not* shown at the Plastics Exposition as erroneously reported in the July issue of Modern Plastics.

Cost of polypropylene. Montecatini reports that a small amount of polypropylene from a pilot plant is available in Italy at approximately 43¢ a lb., which is the same price as polyethylene in that country. The company is scheduled to be producing several tons a day by the end of this year.

Its future cost is far from determined. The raw material, propylene, is primarily a waste product from petroleum refineries today, although a sizeable amount is sold in a 30 to 40% mixture with propane, called L.P.G., a "bottled" gas used for heating. The price of L.P.G. is about 2¢ a lb. or 9¢ a gallon. If a pure stream of propylene were to be produced it would sell for at least 4¢ a lb., according to a competent petroleum company estimator. The selling price for ethylene today is around 5¢ a pound. There is also a possibility that ethylene and propylene may be produced simultaneously, thus creating a different price for each.

But there is no assurance that raw material costs will determine final cost of this isotactic polypropylene. Unless Prof. Natta, the discoverer, has found a unique method for separating the useful or isotactic polymer from a useless residue, the processing cost is high. The residue may be 20% or more

* Reg. U. S. Pat. Off.

of the total mass. At least it has been that much in all experimental work to date. Incidentally, by broad definition, "isotactic" means that the molecules are closely packed together in a spiral formation. The scientific description is: a steric structure which is highly crystalline.

What's the future for polypropylene? Anyone who can answer that question is indeed a wizard. Its test-tube properties are exciting, but until there is enough commercial production available so that its practicability can be evaluated, there is little sense in processors of plastics materials making a mad rush to get under the tent. As a rule, users of plastics don't give a hoot about such things as isotactic, steric structure, royalties, licensees, and such matters. They want to know what the material will do . . . how does it process . . . how much will it cost . . . will there be a steady source of supply?

Industrial users of plastics should not be unduly confused about the possibilities of a plastic that is only an infant nor should they be encouraged to delay adoption of present plastics materials to their immediate needs on a "wait and see" basis.

The lesson learned from the commotior created by low-pressure polyethylene should prove this point. Almost 1½ years have gone by since samples were introduced and large-scale production is still months away. And perhaps the most dangerous thought of all is to believe that polypropylene will completely outmode polyethylene.

Texas Eastman announces plans for new polyethylene. A semi-commercial manufacturing unit for production of polyethylene by a low-pressure process at Longview, Texas, has been announced by Texas Eastman. The new unit, to be modest in size, will be used for experimental production by a process developed by Standard Oil Co. of Indiana and licensed to Eastman Kodak Co., parent company of Texas Eastman.

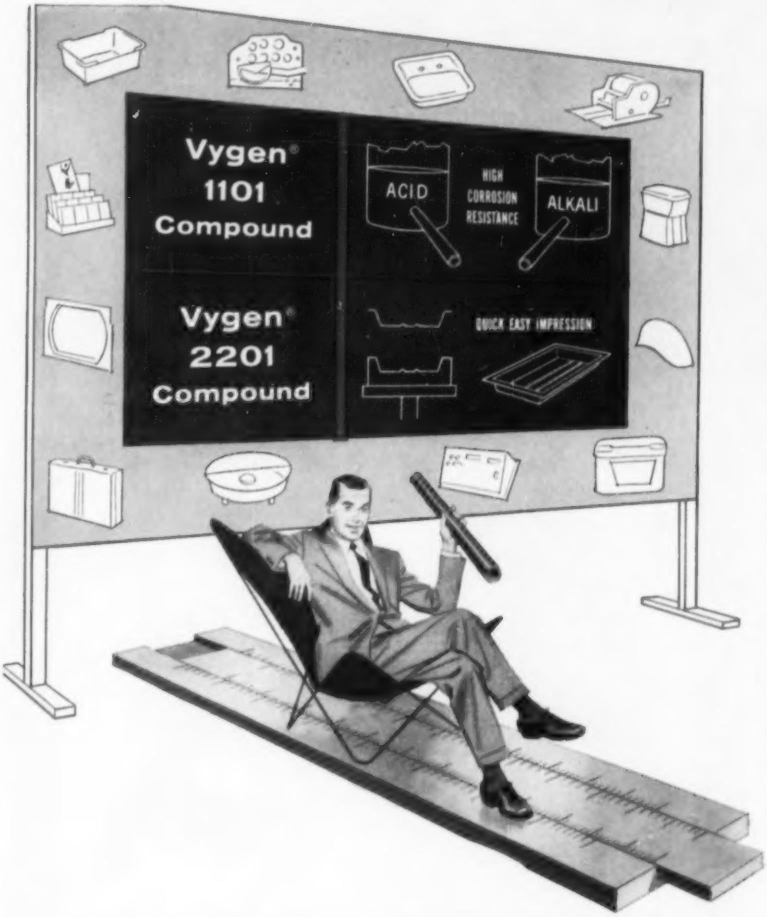
Standard is known to have been working with polyethylene since the middle 1940's. The license to Eastman is for commercial production of high-density polyethylene and *polypropylene* under more than 20 patents issued since 1951. Standard claims that its material has higher impact strength and other advantages over other linear or high-density polyethylenes, that the process has the advantage of continuous operation, and that the catalyst does not need regeneration. Since it is granular or "solid," the catalyst can be filtered out to yield polyethylene of low ash content.

As we go to press, Spencer Chemical Co. has also announced completion of arrangements with Standard of Indiana for a license to produce low-pressure polyethylene and polypropylene.

Union Carbide also steps up polyethylene activity. Two new plants for production of polyethylene by the low-pressure process have been announced by U.C. Total capacity of the two plants at Institute, W. Va., and Seadrift, Texas, will be 55 million pounds. The first will be completed in early 1957, the second a few months later. Both Ziegler and Phillips processes will be used, together with "technological improvements for olefin polymerization" developed in the company's own pilot plants. The company is careful to state that this new family of plastics will broaden rather than replace the original high-pressure polyethylene. Union Carbide already has more than 250 million lb. of capacity for high-pressure polyethylene.

(*To page* 45)

Design for Expanding Markets



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- ☐ VYGEN-110 Polyvinyl chloride resin
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- ☐ Vygen-2201 Compound Rigid PVC (calendering)

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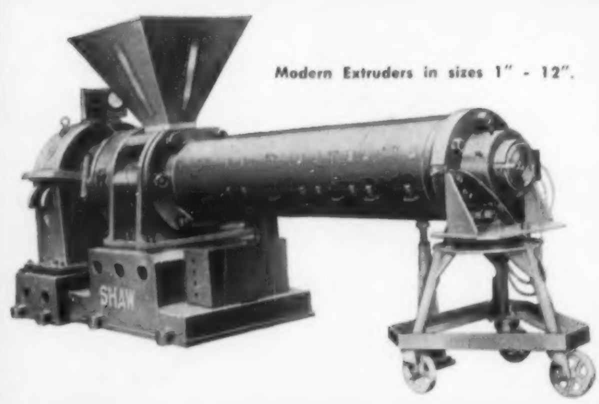

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The Plastiscope

(*Continued from p. 42*)

PVC pipe on shipboard. The largest application yet found for rigid PVC pipe in the U. S. is its use for carrying sea water to wash down all exterior parts of a Navy vessel that has been subject to contamination by radioactive fallout during and after an atomic attack. Every ship in the Navy will be thus equipped. Metal pipe posed serious problems that vinyl could overcome; furthermore, a vinyl pipe installation has only one fourth the weight of steel. Total poundage of vinyl to be used is perhaps greater than all PVC pipe now installed in civilian operations. The prime contractor for the wash-down system is Grinnell Corp., Rhode Island. Grinnell obtains the pipe from several vinyl pipe extruders who are using Goodrich Geon 8700, a modified high-impact unplasticized vinyl chloride formulation. Full details will appear in MODERN PLASTICS at a later date.

Increased methacrylate capacity. Du Pont is doubling its production of methacrylate monomer at Belle, W. Va. Increased use of the material for molding powder, granular polymers for extrusion of sheet, resin compositions for dental applications, and especially acrylic automobile paints are expected to take up the increased production. The project will be completed in two years. Total consumption of methacrylate monomer is thought to have exceeded 50 million lb. in 1955, with Du Pont supplying less than half of the total. The company discontinued production of cast methacrylate sheet several years ago and chose to center its attention on encouragement of processors who would concentrate on extruded methacrylate sheet.

Plasticizer sales. U. S. Tariff Commission reports just issued show that the 1955 total sales was 337 million lb. compared to 247 million in 1954. A rough estimate would be that about 250 million lb. of the total was used for vinyl chloride products. D.O.P. registered 59 million lb. in 1955 compared to 41 million in 1954. Sales of D.I.O.P. and a minor amount of kindred material were 29 million lb. in 1955 and 27 million in 1954. An interpretation of this report will be printed in MODERN PLASTICS later this year.

New higher density high-pressure polyethylene. Bakelite Co., a Div. of Union Carbide, has also announced a new intermediate density high-pressure polyethylene that gives greater rigidity to large molded parts than do its older resins. Designated DND-0400, the new resin also imparts improved gloss, harder surface, non-skinning properties, and improved heat resistance to molded items. Molders can use it to produce large moldings that will be more rigid than if made of older polyethylenes, without increasing wall thicknesses. The new resin, with a density of approximately 0.923 as compared to the company's previous highest density material of about 0.918, is a new member of the growing family of so-called intermediate density high-pressure polyethylenes. So

far Bakelite has said nothing about a film-grade resin of this intermediate density type. For further discussion of intermediate density polyethylene, see page 234 of this issue.

Extruded copolymer sheet. Campco Div. of Chicago Molded Products has announced availability of extruded copolymer styrene sheet. Sheets made of acrylonitrile-styrene material previously were available only in calendered form and thick sections were produced by laminating. The new extruded sheet is said to have improved strength and color and can be obtained in sizes up to 3/16 in. thick. It is free from internal strain and can be readily vacuum formed into complex shapes and deep draws. It may be used for automotive applications such as panels, liners, and seat skirts. Campco also emphasizes the use of its rubber-modified styrene sheet as the outer and inner skin to enclose Styrofoam for structural panels especially useful for refrigeration in food plants, bakeries, trucks, and domestic refrigerators. This material is known as Hasko-Struct and is produced by Haskelite Mfg. Co.

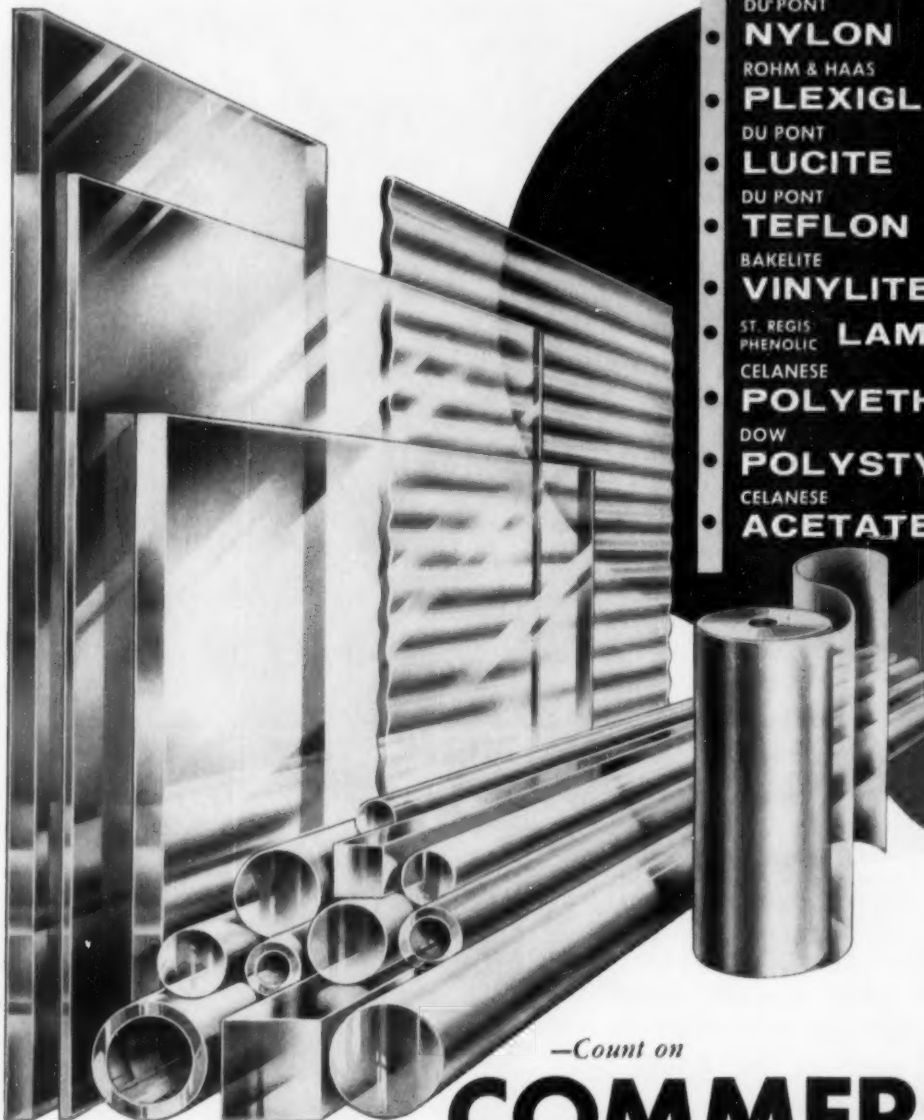
Coated Mylar. Facilities for coating Mylar polyester film will be installed at Du Pont's Circleville, Ohio, plant immediately. The installation will be completed in late summer, 1957. The coating will make Mylar heat-sealable on standard packaging machinery and improve its impermeability. At present the material is sealed by using a combination of heat and a solvent, benzyl alcohol, but the packaging machines have to be modified. Old and new uses emphasized for Mylar in Du Pont's latest bulletin are: capacitors for radios and Hammond organs, swim suits using Mylar metallic yarn, silver and gold metallized trim in airplanes, sound tape, and surgical wound dressings. A new method for dyeing the film is reported to have been developed by Martin Processing Company of Martinsville, Va.

Teflon expansion. Du Pont will double its production of Teflon 6 tetrafluoroethylene resin, a fine-powder composition developed for extrusion and first produced in commercial quantities last fall. Since its introduction, the material has been in demand for hose and tapes in electrical insulation as well as insulation for wire and cable.

H-P-M merger. Hydraulic Press Mfg. Co., Mount Gilead, Ohio, manufacturer of presses for the plastics industry and other machinery, has merged with the Kochring Co. of Milwaukee. No changes in the management of H-P-M are contemplated. Kochring has been actively entering new markets since the end of the war. Its products include railroad equipment, pipeline materials, heating and pressure boilers, mining machinery, and many other heavy equipment items.

Unmerged. The recently announced merger agreement between W. R. Grace & Co. and Cosden Petroleum Corp. has been terminated. According to a Grace publicity release, Cosden's proved reserves of crude oil were below the minimum figure of 17,765,000 barrels stipulated in the agreement. Cosden had recently reported that the company would build a 20 million-lb. styrene monomer plant in Texas by a new method that would reduce costs.

For additional and more detailed news see Section 2, starting on p. 234.



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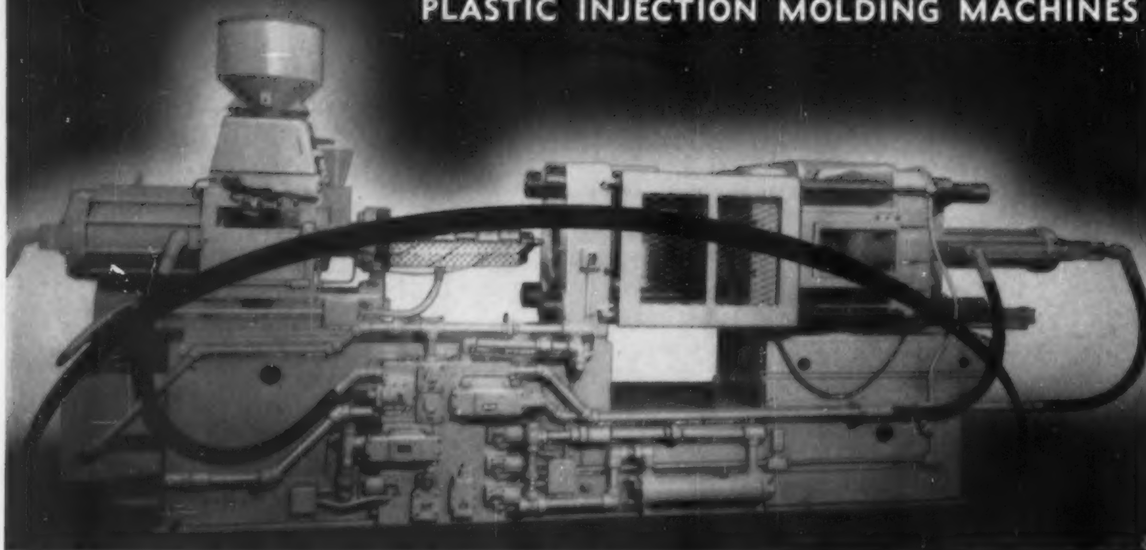

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- **COMPENSATED WEIGH FEED** is standard. Material savings up to 15% possible.
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- **CENTRALIZED VALVE** panel gives complete accessibility to every hydraulic valve.
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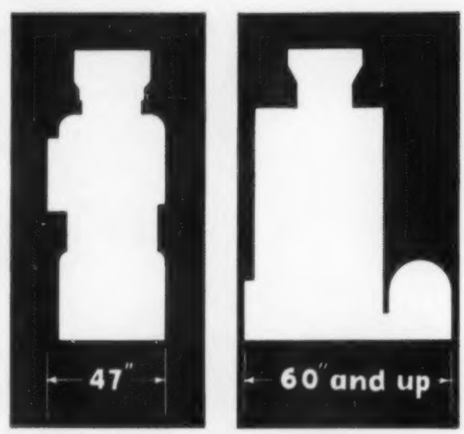

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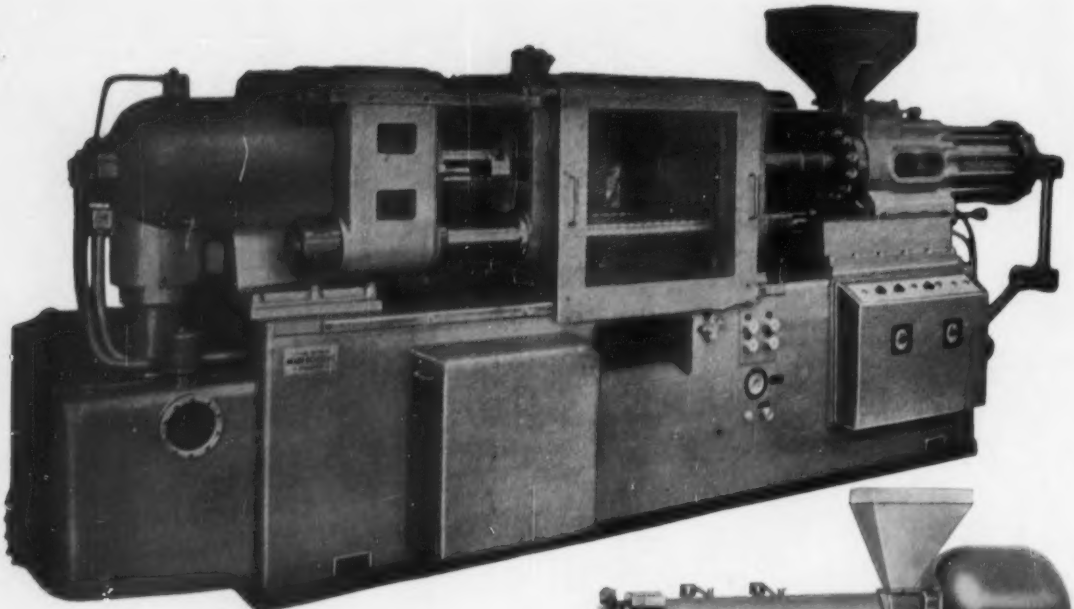

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INJECTION PRESSES—Negri Bossi injection presses, like the NB 360/520 shown here, can be set up almost anywhere because they get their operating pressures from a built-in oil-hydraulic drive that needs only electricity to operate. The new-design electrical system makes service and operation simplicity itself. Service of the cylinder, screw, nozzle and heaters is also simple; they can be removed as a unit by just one person. The operator is protected by an automatic device that prevents operation when the safety gate is open. Automation is a built-in feature of Negri Bossi presses; simply by shifting a lever, the operator can choose semi-automatic or fully-automatic cycling.

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The sound counselling, pressed upon management by technical men for years, has been featured in a challenging series of advertisements over the Firestone Exon signature. It has alerted top-management to the effect of corrosion on every job and function of industry.

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Whatever corrosives you use, whatever equipment you must protect, drop a note to Firestone today.

Firestone EXON

Who tripped up the Chairman of the Board with a corroded beam?

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Who chained the Executive Vice President to his desk with a lot of corroded metal?

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Who keeps boxing in the Traffic Manager with corroded grates?

Firestone EXON

What's that corroded flue doing in the Treasurer's office?

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"That'll be $10 for the order and 25¢ for the corrosion!"

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CHEMICAL SALES DIVISION • Firestone Plastics Co., Dept. 62K, Pottstown, Pa. • A Division of the Firestone Tire and Rubber Co.

"MEIKI" INJECTION M.M.

Specially designed long cylinder assures quick and uniform melting; the cylinder can be easily replaced.

Hydraulic clamping system eliminates troublesome staynut adjustment.

U.S. Standards are adopted on machine parts, European are also available if requested.

Either Meiki hydraulic system or Oilgear's can be fitted at your option.

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Fully Hydraulic
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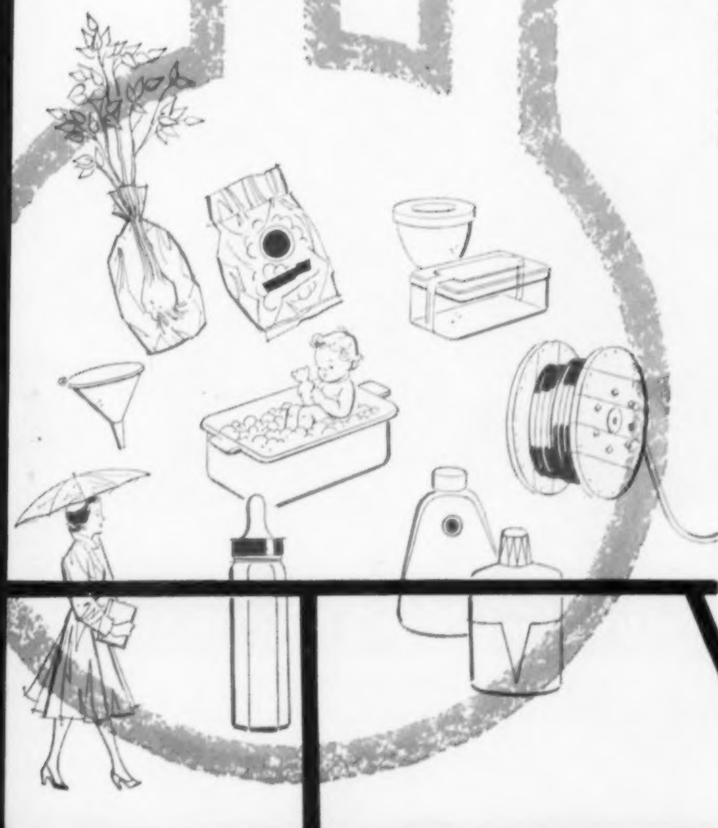
MODULENE*

VIRGIN POLYETHYLENE

... available for extrusion and injection molding

Modulene has outstanding low temperature flexibility and toughness, superior chemical inertness, freedom from taste, odor and toxicity, excellent dielectric properties, low specific gravity (.92) and low water vapor permeability.

Modulene's superior properties can offer you production savings and improved products design.



Inquire also about new Super Modulene, the amazing, new High Modulus Polyethylene* that offers greater heat tolerance, toughness, rigidity and chemical resistance.

H. MUEHLSTEIN & CO.

60 East 42nd Street
New York 17, N. Y.

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**Manufactured by Koppers Company, Inc.*

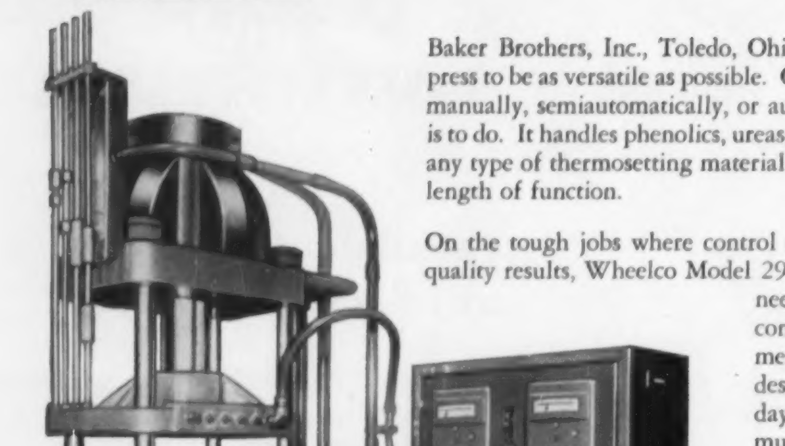
THE MARK OF QUALITY

BARBER COLMAN

Wheelco Instruments

A Baker's dozen features — and Wheelco precision control, too!

MORE THAN 95% of the plastic molders in the Buffalo area have expressed their preference for Wheelco Instruments. Wherever plastic machines are used, Wheelco furnishes precise, dependable control at low cost.



Baker Brothers, Inc., Toledo, Ohio designed this Plastimatic molding press to be as versatile as possible. Completely flexible, it can be operated manually, semiautomatically, or automatically, depending on the job it is to do. It handles phenolics, ureas, alkyd, teflon, melamines . . . in short, any type of thermosetting material. And, it is adjustable as to time and length of function.

On the tough jobs where control of mold temperature is essential for quality results, Wheelco Model 297 Capacitrols furnish precise control needed. But, they offer more than close control of temperature. Every instrument is built with the Barber-Colman designed-in dependability that means day-in-day-out performance with minimum downtime or maintenance.

Get the full story of Wheelco design superiority and dependable performance that has brought Wheelco undisputed leadership in the plastics field. Call your Wheelco sales engineer today, let him show you what Wheelco can do for you!

These Baker automatic plastic presses range from 25 to 450 ton capacity. Wheelco Model 297 Capacitrols are available for close control of mold temperature.

WHEELCO INSTRUMENTS DIVISION

Barber-Colman Company

Dept. H, 1517 Rock Street, Rockford, Illinois

BARBER-COLMAN of CANADA, Ltd.

HOW COULD

ATLAC®

POLYESTER RESIN

solve your problem?

WITHSTANDS HEAT

"Much of the equipment we make is subjected to prolonged heating in use. We eliminated complaints about buckling or warping of laminated moldings by switching to ATLAC 382. Its high heat resistance, higher heat distortion temperature, and excellent electrical properties make it exactly suited to our needs."

—Electrical Equipment Manufacturer

INCREASES PRODUCT SALEABILITY

"We turned to ATLAC 382 to gain the extra sales appeal of high gloss, smooth surface, absence of 'after-odor' in our product. ATLAC features like high impact strength, high chemical resistance help keep customers satisfied, stimulate repeat business."

—Sales Manager, Plastic Molder

ENDS STORING AND MIXING HEADACHES

"We like ATLAC because it's a dry powder—doesn't age or cure prematurely in storage. What's more, it's easy to mix ATLAC to the exact consistency we need for any job, simply by adjusting the ratio of monomer to get any viscosity from 500 to 6000 cp."

—Production Supervisor

RESISTS CHEMICALS

"Conventional polyesters just didn't give us the serviceability we need. We checked out ATLAC 382 in our plating bath, and found it to be superior in chemical resistance to any polyester we ever used. And since we switched to ATLAC we're no longer bothered by leakage problems—it's really rugged stuff."

—Manager, Electroplating Department

. . . Write to Atlas for data and samples.

CHEMICALS DIVISION

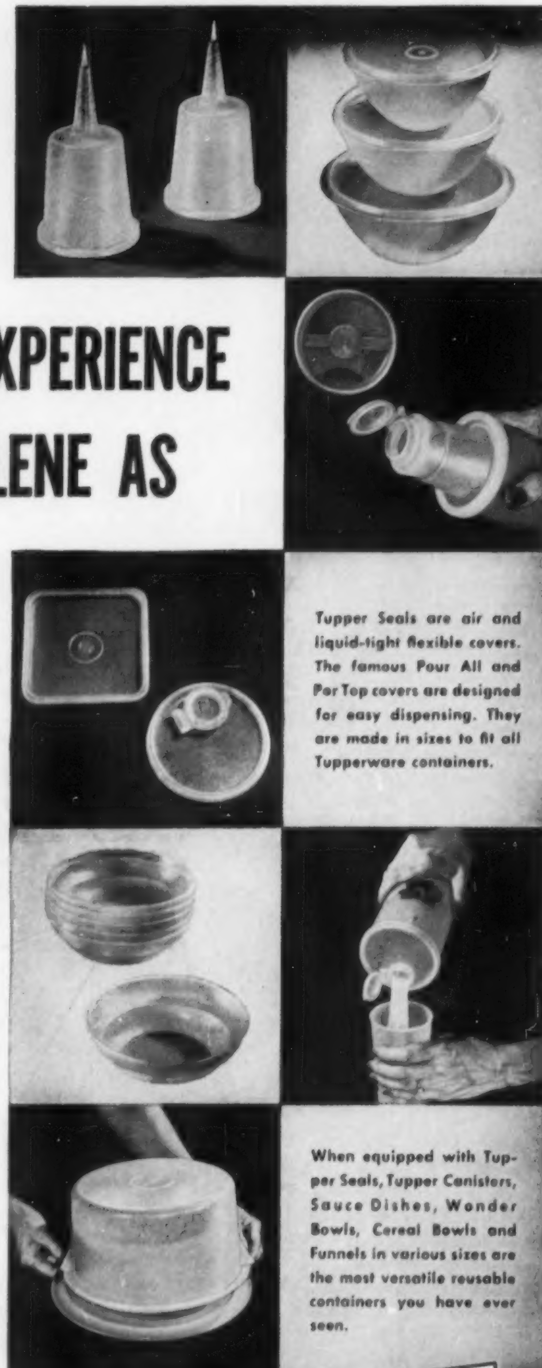
ATLAS POWDER COMPANY

WILMINGTON 99, DELAWARE

In Canada: Atlas Powder Company, Canada, Ltd.
Brantford, Ontario, Canada

NOBODY HAS AS MUCH EXPERIENCE AT MOLDING POLYETHYLENE AS

TUPPER!



Tupper Seals are air and liquid-tight flexible covers. The famous Pour All and Por Top covers are designed for easy dispensing. They are made in sizes to fit all Tupperware containers.

When equipped with Tupper Seals, Tupper Canisters, Sauce Dishes, Wonder Bowls, Cereal Bowls and Funnels in various sizes are the most versatile reusable containers you have ever seen.

The logical molder for you to consult regarding that product or package of yours which is to be made of polyethylene is Tupper. Tupper has done more than any other molder to make molded polyethylene a practical reality.

Aside from having designed, patented, and promoted successful seals, closures, and dispensers for polyethylene containers, the Tupper Corporation has vast experience in *every phase* of polyethylene packaging and polyethylene injection molding. This experience will be of major importance in improving your product, in reducing your costs, when Tupper goes to work for you.

Tupper's combination of experience, technical ingenuity, and the most modern equipment is at your service for the custom molding of your product in polyethylene. You can do no better than the best ... and the best at molding polyethylene is Tupper!

TUPPER!

TUPPER PRODUCTS ARE FULLY PROTECTED

About 150 United States and foreign patents and patents applied for, plus numerous trademarks and copyrights, cover the design and manufacture of the various types of Tupper Seals and other Tupper Products. Unauthorized manufacture of items covered by Tupper patents will subject infringers to prosecution.

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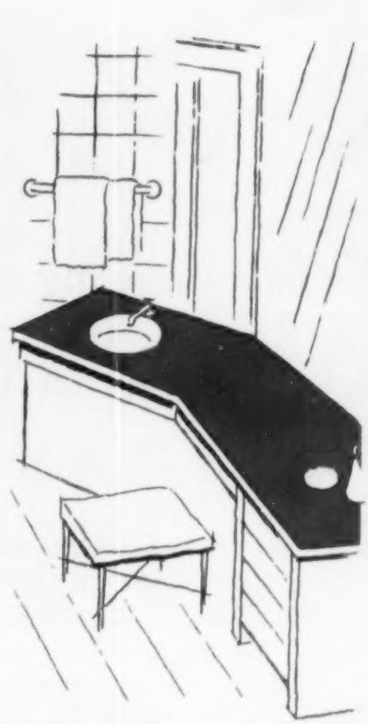
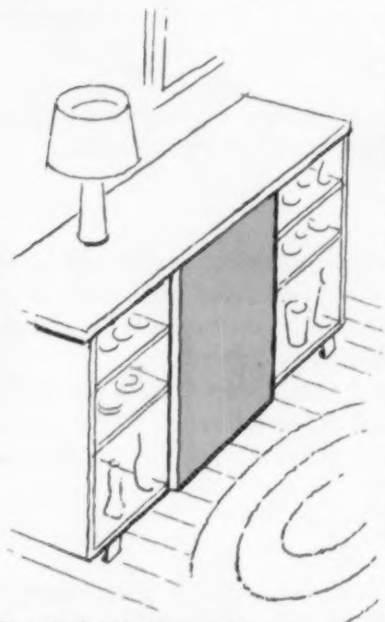


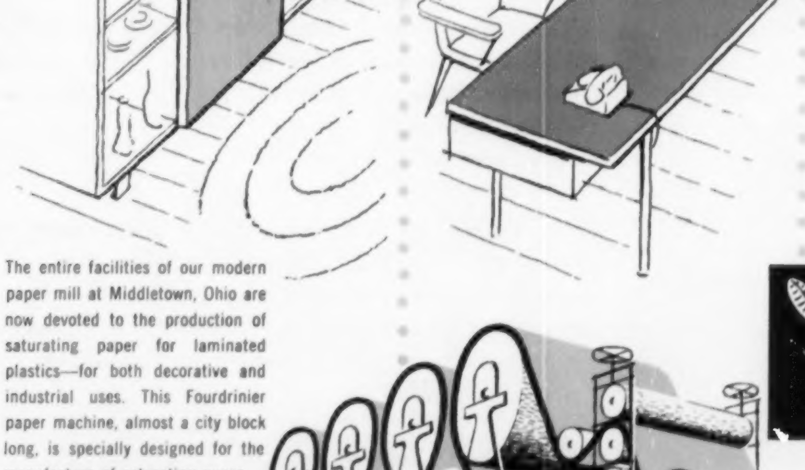
LAMINATED PLASTICS!

They bring a cheery chuckle of color into people's homes, into people's lives. Into modern stores and offices, too.

We're proud to be the supplier of Saturating Paper to the leaders in this field. We have the know-how and the facilities to match in saturating paper any color submitted to us—or to create new, distinctive shades.



The entire facilities of our modern paper mill at Middletown, Ohio are now devoted to the production of saturating paper for laminated plastics—for both decorative and industrial uses. This Fourdrinier paper machine, almost a city block long, is specially designed for the manufacture of saturating paper.



Jenny Wrenn — for almost 100 years the symbol of highest quality in the absorbent paper field.

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Important news for policy-making executives—

A Market Research Organization that Specializes in Plastics and Packaging!

Modern Plastics Research Corporation was founded to help you chart profitable new areas of operations in the fast-growing markets of plastics and packaging.

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Nevertheless, the prudent executive charged with shaping policy knows that the plastics and packaging fields are complex. To steer a knowledgeable course calls for highly specialized research by experts who *know* the fields, their problems, and their personnel.

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What The Company Is

Modern Plastics Research Corporation is staffed by specialists in all phases of plastics and packaging: present and potential applications, developments in materials and technology, marketing and distribution.

The firm is affiliated with Modern Plastics and Modern Packaging magazines. It has full access to the accumulated experience and knowledge of these publications and their staffs.

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How To Use Its Services

If you are looking for a fresh approach to your own program of expansion—or if you feel the need for thoroughly researched facts concerning your current operations—then M-P-R's services can be extremely valuable. For further details, write today without obligation for free descriptive Booklet "B."

All communications and inquiries held in strictest confidence.

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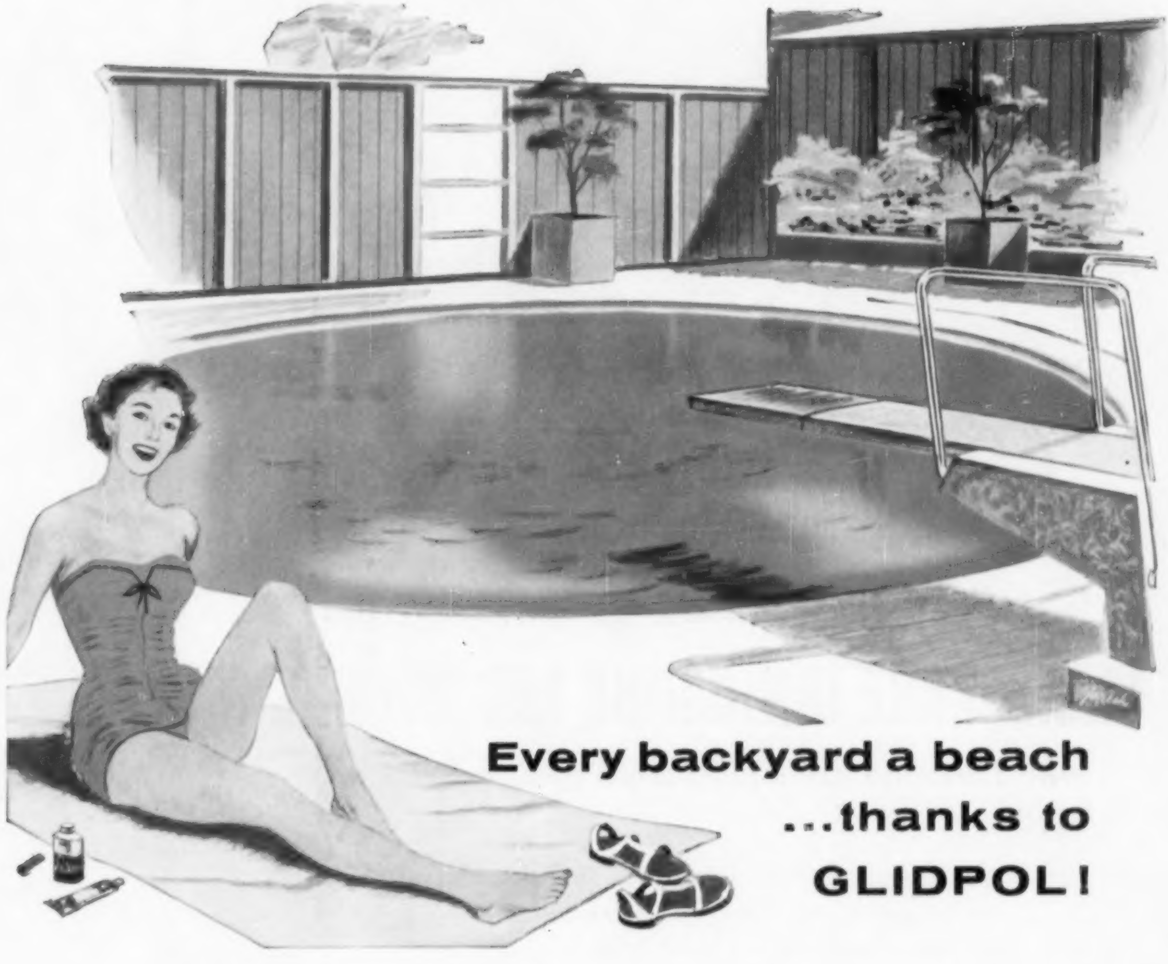

Every backyard a beach ...thanks to GLIDPOL!

Now, almost everyone can afford a private swimming pool thanks to the mass-produced, budget-priced pools made of Glidpol* reinforced fiberglass.

Pools made of Glidpol won't rot or mildew; resist chemical action, weather and temperature changes. There's little maintenance required because the smooth surface won't hold dirt or marine growth and the color is sealed in by the durable Glidpol-fiberglass bond.

Leading manufacturers know they can depend on Glidpol for consistent batch uniformity and other important product advantages. As a plastics producer, you, too, should investigate this versatile polyester family and its application in your products. Write for complete information.

*A Glidden Trade-Mark

A request on your company letterhead will bring you a copy of Technical Bulletin MP-856 which fully describes all of the Glidden GLIDPOL resins for casting, laminating, molding and coating.

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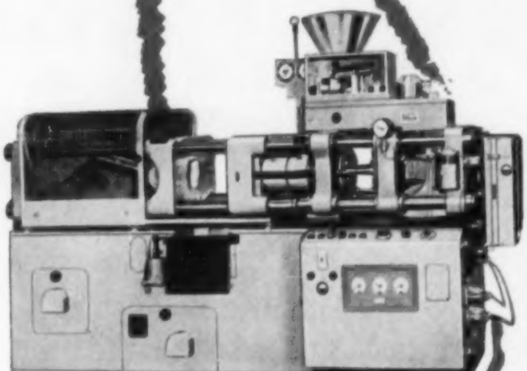
It sure pays

to approach us with your production problems because

this machine



BSM 40 s 2 ozs.

Battenfeld fully automatic Injection Molding Machine

Model BSM 40 S equipped with special dosing scale - built in series - is the most prominent one in Europe and a symbol and basis for up-to-date and efficient performance,

+ *our advice*

on the construction of your molds. We have a mold building division, expertly run and ready to work on your requirements, too,

+ *our service*

the best you can imagine and renowned in all parts of the world. Our servicing engineers will install the machine you order and will supervise its initial production upon request

100 % solution

BATTENFELD

Injection Molding Machines, 1/4 up to 50 ozs.
(electro-mechanical drive)
MEINERZHAGEN/WESTF. · GERMANY

Strip away five plastisol processing troubles with "Dutch Boy" Stabilizers

...simplify organosol production, too

Stabilize vinyl plastisols with "Dutch Boy" and you go a long way towards solving five common problems.

The first is high heat sensitivity in dispersion resins for plastisols (and organosols). "Dutch Boy" Stabilizers cut this sensitivity down.

Then come three molding problems . . . plate-out of colorants, hard stripping, discoloration from interaction of product and mold. "Dutch Boy" Stabilizers help overcome these three.

Lastly, there's the tendency of stored dipping or spreading plastisols to build-up viscosity. "Dutch Boy" Stabilizers help keep these compounds at best working body.

There are "Dutch Boy" Stabilizers for every plastisol or organosol

Take brightly colored fabric coatings for outdoor use. "Dutch Boy" Dyphos® supplies the ultra-violet screening they need.

Take "clears". Take toys. They call for a stabilizer that gets along well with sensitive plasticizers . . ."Dutch Boy" Provinite.

Take injection molded "opaques". "Dutch Boy" Tribase and DS-207® team up to protect them against high heat.

So it goes. There are "Dutch Boy" Chemicals for every stabilizing problem you may run into with vinyl plastisols or organosols.

For every bodying problem, too! Look into "Dutch Boy" BENTONE® Gelling Agents to improve viscosity in both types of compound.

For more information on "Dutch Boy" Stabilizers and Gelling Agents, write National Lead's Technical Staff.

Dutch Boy® CHEMICALS

NATIONAL LEAD COMPANY

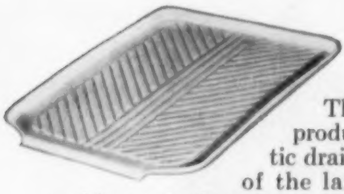
111 Broadway, New York 6, N. Y.

In Canada: CANADIAN TITANIUM PIGMENTS LIMITED
630 Dorchester Street, West, Montreal

even for the big ones it's

CRUCIBLE CSM 2

. . . from warehouse stock



The mold which produced this plastic drainboard is one of the largest plastic molds ever built on the west coast. A block of CSM 2 was the steel used . . . obtained from local *Crucible warehouse stock.* L. D. Plastic Tool and Die Co., South Gate, California, built the mold for Alladin Plastics, Inc., Los Angeles.

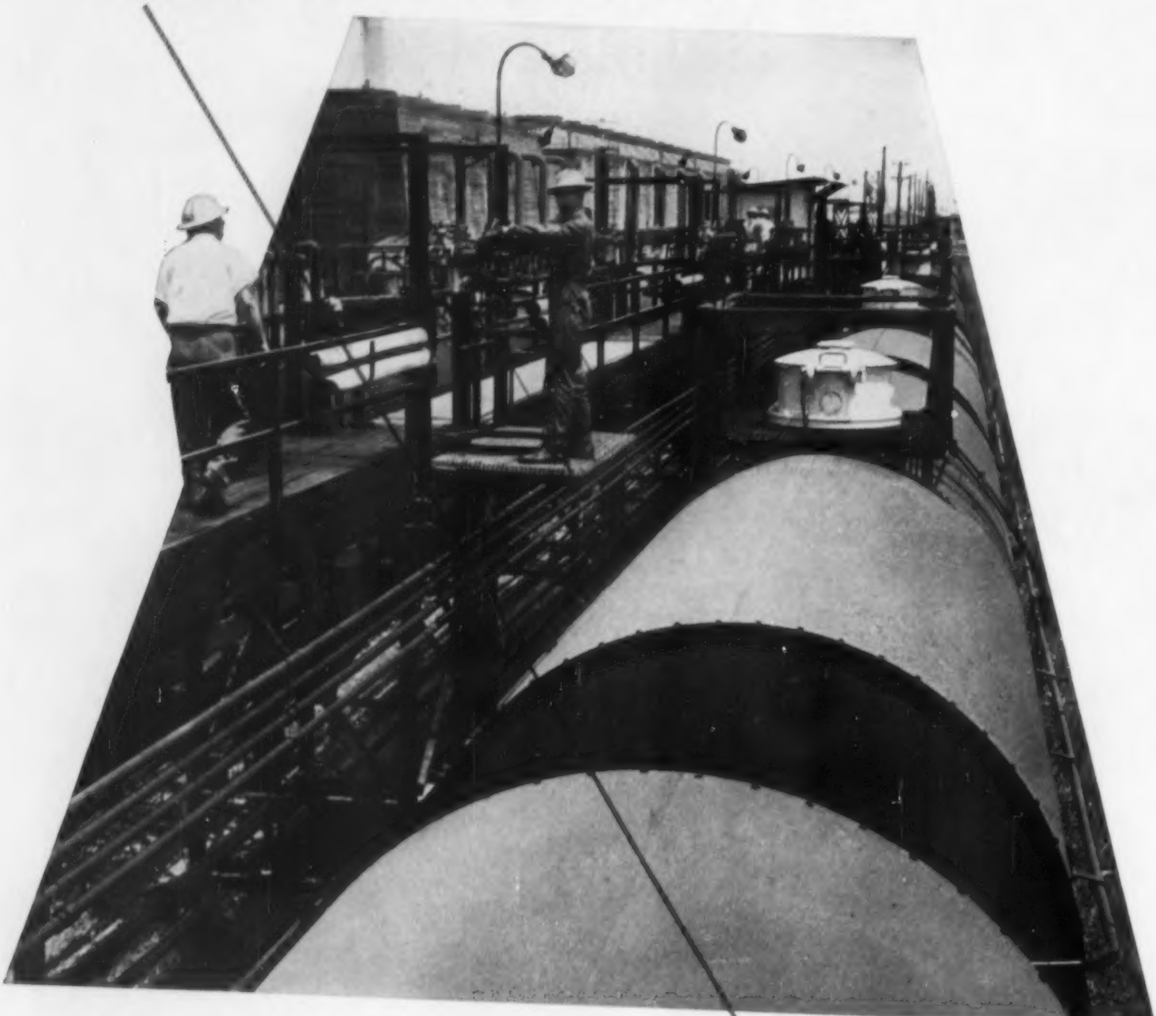
CRUCIBLE CSM 2 was the choice for two big reasons—*quality* and *convenience.* Ultrasonic inspection of *every* piece, regardless of size, insures unvarying quality. And regular stocks of 205 different sizes of CSM 2, carried in Crucible warehouses, means *fast* delivery whether your application calls for a pound or several tons.

Next time you need mold steel, call your nearest Crucible warehouse. The steel you want will be in your plant in a matter of hours. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE **first name in special purpose steels**

Crucible Steel Company of America

soon there'll be more



Our Houston butadiene plant is operating well above rated capacity, primarily for GR-S rubber use.

But butadiene can foster a wide range of better plastics, fibers, coatings, films, adhesives, elastomers, etc., once it becomes freely available in volume. That is why we are expanding capacity by more than 50%.

Discussion of your needs for butane-derived petrochemicals is cordially invited.

Petro-Tex

PETRO-TEX CHEMICAL CORPORATION

HOUSTON 1, TEXAS

A JOINT ENTERPRISE OF

FOOD MACHINERY AND CHEMICAL CORPORATION AND TENNESSEE GAS TRANSMISSION COMPANY

Copyright by Petro-Tex Chemical Corp., 1956

"There are many reasons why we chose Dake Plastics Presses to mold glass reinforced decorative panels for the home and building industry. But none is more important than those that mean savings in production time. Dake automatic controls reduce the human error factor . . . make it possible to train operators in a matter of hours to become push-button molding specialists."

—SAYS GENE SCHRAMM, PRESIDENT
TerraStone, Inc., Franklin Park, Illinois
(Suburb of Chicago)

A bank of three 50-ton capacity Dake Guided Platen Presses (above) used by TerraStone, Inc., Franklin Park, Illinois, to mold glass reinforced decorative panels.

JOB ENGINEERED TO MOLD REINFORCED PLASTICS

DAKE PRESSES

SPEED OUTPUT . . . REDUCE COST WITH THESE 7 FEATURES:

Guided Platen for accurate alignment.

Control can be automatic, semiautomatic, or manual.

Fast Ram Approach speeds closing of movable platen which slows automatically as work is approached.

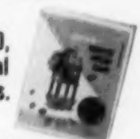
Pressure Adjustable from half to full press capacity.

Electric Timer holds pressure during curing cycle—adjustable from 12 sec to 6⅔ min—after which ram returns automatically.

Capacities from 25 to 300 tons.

Heated Platens can be provided.

Write for Bulletin 340, and tell us your special requirements.



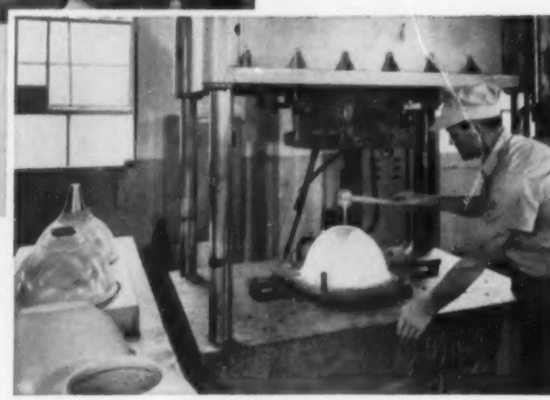
DAKE CORPORATION 648 Seventh St., Grand Haven, Mich.

DAKE PRESSES

Arbor Presses | Hand-Operated Hydraulic | Power-Operated Hydraulic | Guided Platen | Gap Type Presses | Movable Frame

"Pittsburgh Fiber Glass Type 508 Roving helped us improve product quality, reduce rejects and increase output 25%"

. . . says Mr. Charles D. Jones, President
Structurlite Plastics Corporation
Hebron, Ohio



Mr. Charles D. Jones, President of Structurlite Plastics Corporation, holds a pre-form and a molded plastic safety helmet made with Pittsburgh Fiber Glass Type 508 Roving.

Resin is poured over the pre-form in preparation for molding an industrial light shade in a 100-ton hydraulic press. Pittsburgh Roving is uniform, soft and easy to handle.

Structurlite Plastics Corporation prides itself in producing quality glass-reinforced plastic products, ranging from school desk units and industrial light shades to juice dispensers and baseball protective caps. And Pittsburgh Fiber Glass Type 508 Roving is a major factor in assuring this quality production.

Mr. Jones reports, "The unusual softness and pre-forming quality of Pittsburgh Type 508 Roving reduces the amount of binder required in the pre-form to help it keep its shape. The lesser amount of binder results in a more durable merchandise and a better appearing product.

"We began using Type 508 Roving in 1953. Rejects which previously ran as high as 12 per cent were reduced to five per cent. This Type 508 Roving has helped increase output as much as 25 per cent. To say we are pleased with its performance is putting it mildly."

WHAT CAN PITTSBURGH TYPE 508 ROVING DO FOR YOU?

If you are not satisfied with the reinforcement you are now using, perhaps Pittsburgh Type 508 Roving can offer you similar production advantages. We will be glad to arrange "in your plant" tests by our technical staff. Contact our executive offices or one of our district sales offices listed below. *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pennsylvania.*

PITTSBURGH FIBER GLASS TYPE 508 ROVING IS A PRODUCT OF THE FIBER GLASS DIVISION OF PITTSBURGH PLATE GLASS COMPANY

Sales offices are located in the following cities: Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia and St. Louis

FIBER GLASS

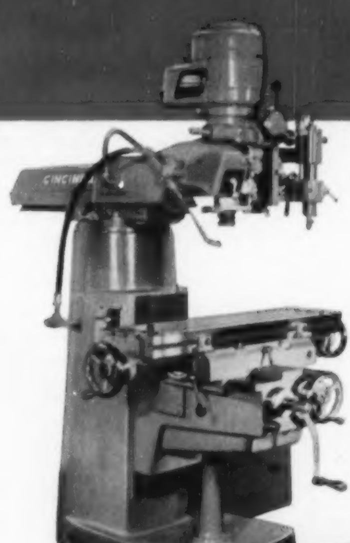
PAINTS · GLASS · CHEMICALS · BRUSHES · PLASTICS

PITTSBURGH PLATE GLASS COMPANY

Automatic Hydraulic Depth Control Unit, standard feature

CINCINNATI CONTOURMASTER

. . . master of your medium-size tool and die work



NO. 1B CONTOURMASTER MILLING MACHINE

The Contourmaster Tool and Die Milling Machine developed by Cincinnati Milling is a member of the world's greatest family of hydraulic tracer controlled machine tools. The Contourmaster is built in two styles, 1A and 1B, differing primarily in table size and location of handwheels. Both styles are equipped with Cincinnati Automatic Hydraulic Depth Control, which operates from a few ounces of contact pressure . . . three-dimensional positioning of tracer mechanism . . . ram mounting of spindle carrier for increased cross range. Many cost-reducing features are combined in this great new CINCINNATI . . . the Contourmaster . . . master of all small- to medium-size tool and die work. Get the complete story by writing for catalog No. M-1919.

THE CINCINNATI MILLING MACHINE CO. CINCINNATI 9, OHIO

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In PLASTICS, the plant that does everything!

THESE PRODUCTS:

GERING "the Hose with the Mirror Finish."

GERLITE Extruded Acrylic Sheets, clear or colored, to 54" wide, to .125" thick, any practical length. For Illuminating Signs, Lighting Fixtures and Vacuum Forming Applications.

GER-FLEX Vinyl Tubing

GER-TUBE Polyethylene Tubing from 1/32" to 4" I.D., also special shapes and cross-sections.

DRYCOL on-the-spot, in-plant colorant for all thermoplastics.

S-T-R-E-T-C-H Polyethylene master-batch color concentrate.

STYROMIX Clear polystyrene dry-blended with color and lubricants, ready to mold.

GER-PAK Polyethylene film, sheeting, and tubing for packaging consumer and industrial products. Moisture-vapor barrier up to 20 feet wide, for use in light and heavy construction.

THESE SERVICES:

Molding Powders Division

We manufacture for standard and special applications, for injection and extrusion molding:
Polystyrene • Vinyls • Polyethylene
Cellulose Acetate • Ethyl Cellulose
Acrylic • Nylon

Extruded Products Division

Complete Department equipped with extruders from 2" to 10" with dies and take-off equipment to make Sheeting, Tubing, Rods, Pipe, Special Cross Sections and Shapes.

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Complete facilities for top quality processing. Full staff of laboratory, technical and engineering personnel.
Polyethylene • Vinyls • Nylon • Acrylic • Cellulose Acetate • Butyrate
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Far ahead of any ordinary scrap reclamation is the job done at Gering. Our long experience coupled with skilled technical personnel enables us to work wonders with scrap sorting, separating, grading, decontaminating, blending, color matching, compounding, and pelletizing.

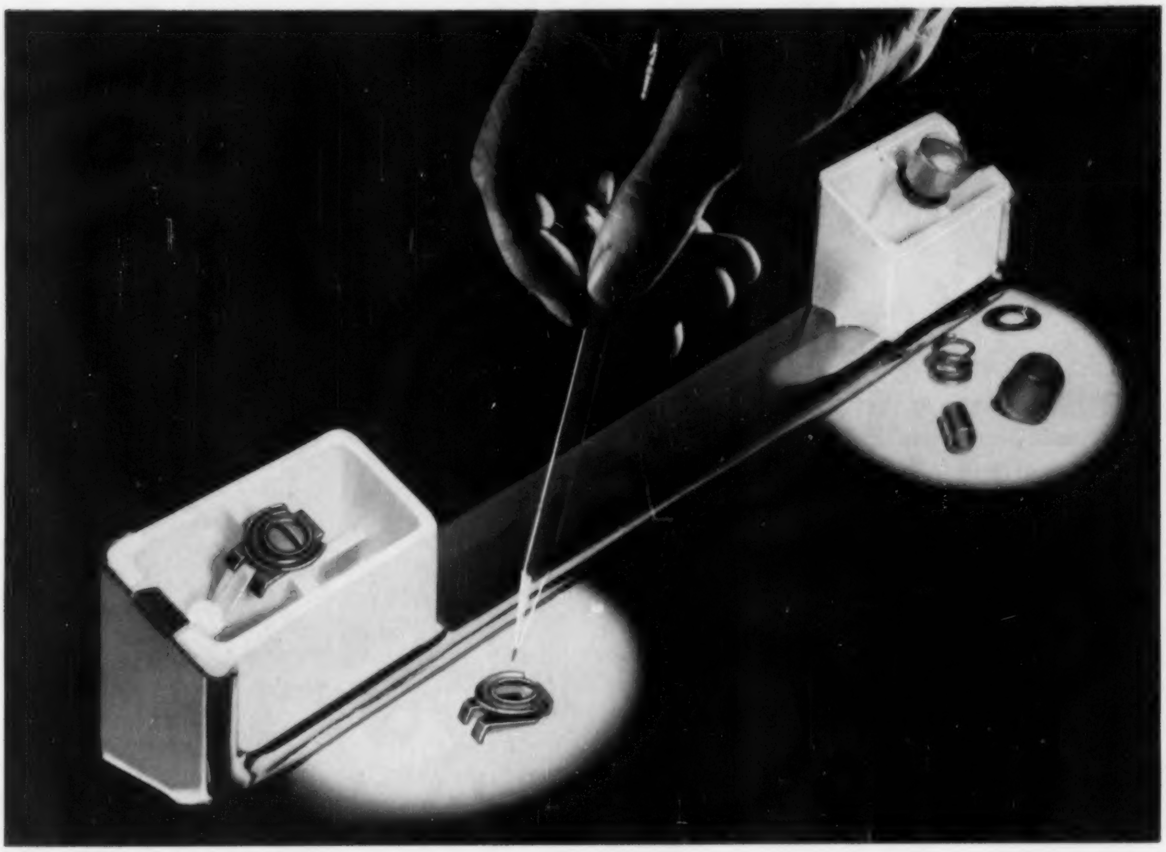
GERING

Service • Quality • Dependability

PRODUCTS, INC.

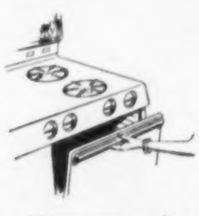
KENILWORTH, N. J.

Pioneers in modern plastics for over 30 years!



Engineered by Tinnerman...

One-Piece SPEED CLIP® replaces 4-part fastener, helps assembly and shipping . . . and saves money!



Four separate parts plus screw were required to fasten each end of the removable door handles on kitchen ranges manufactured by the Caloric Appliance Corporation, Topton, Pennsylvania.

Tinnerman fastening specialists teamed up with Caloric designers to eliminate 3 of the parts!

Now . . . a special one-piece, multi-purpose SPEED CLIP plus screw do the same job more efficiently and at lower cost, and reduce small parts handling. Faster, easier assembly . . . fewer parts to buy, inventory and handle. Packed inside the oven for safe shipment with SPEED CLIPS in place, the door handles are dealer-applied in far less time, can be easily removed by the housewife for cleaning.

The resiliency of the spring steel SPEED CLIP prevents crazing or chipping, enables it to absorb varying panel thicknesses and porcelain enamel build-up. Changeover was made without retooling or redesigning door handle or keyhole-shape mounting holes.

Find out now where SPEED NUT brand fasteners belong on your assembly line. There are more than 8000 variations to choose from. Call your Tinnerman representative for complete details and write for our Fastening Analysis Bulletin No. 336.

TINNERMAN PRODUCTS, INC. • Box 6688, Dept. 12, Cleveland 1, Ohio

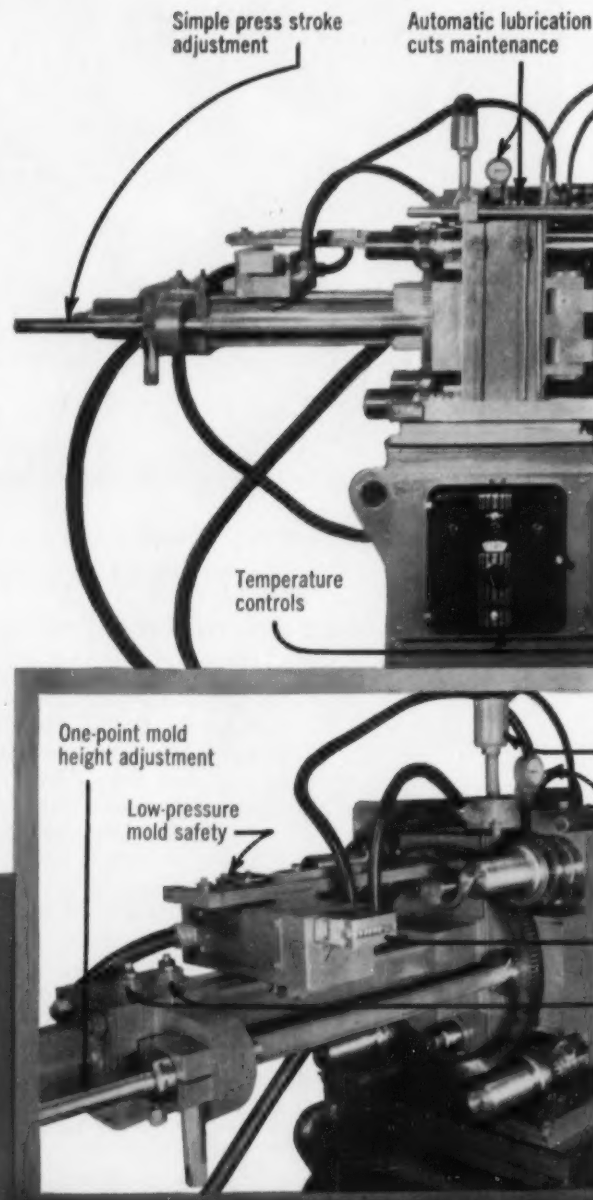
Canada: Dominion Fasteners, Limited, Hamilton, Ontario. *Great Britain:* Simmonds Aerocessories, Limited, Treforest, Wales. *France:* Simmonds, S. A., 3 rue Salomon de Rothschild, Suresnes (Seine). *Germany:* Hans Sickinger GmbH "MECANO", Lemgo-i-Lippe.

TINNERMAN *Speed Nuts*®

FASTEST THING IN FASTENINGS®

Here's why the Fellows

- **SPEED**—The "3-125" is the fastest fully-automatic 3-ounce machine on the market! Features such as *variable stroke adjustment, rapid advance injection,* and new, improved *Speed-Flo heating cylinder* give you dry run speeds from 600 to 840 cycles per hour.
- **CAPACITY**—not only 3 ounces...but you can get shots up to *4.5 ounces* with the optional "pre-pack" device which double strokes the plunger during press dwell.
- **FULLY AUTOMATIC**—One man can operate three or more machines! Temperature, injection pressure, and speed controls are built-in and grouped for easy setting, easy checking. Extra equipment includes counter connections, air-blast connections, alarm timer and mold safety device.
- **EASY SET-UP**—Entire heating cylinder and slide assembly retracts from the mold for purging. Mold opens 5 to 8 inches. Mold height and clamping adjustment set by a single control.
- **AND BONUS FEATURES**—The "3-125" takes molds 10½" x 18½" horizontally, 12" x 17" vertically, 8" to 14" thick...clamping pressure is 125 tons...safety doors have hydraulic and electric interlocks...and many other Fellows features!



Ask your Fellows Representative for information about the complete line of Fellows Injection Molding Machines. And ask him for information about the Fellows Plan for deferred payment.

THE FELLOWS GEAR SHAPER COMPANY,
Plastics Machine Division,
Head Office and Export Dept., Springfield, Vt.
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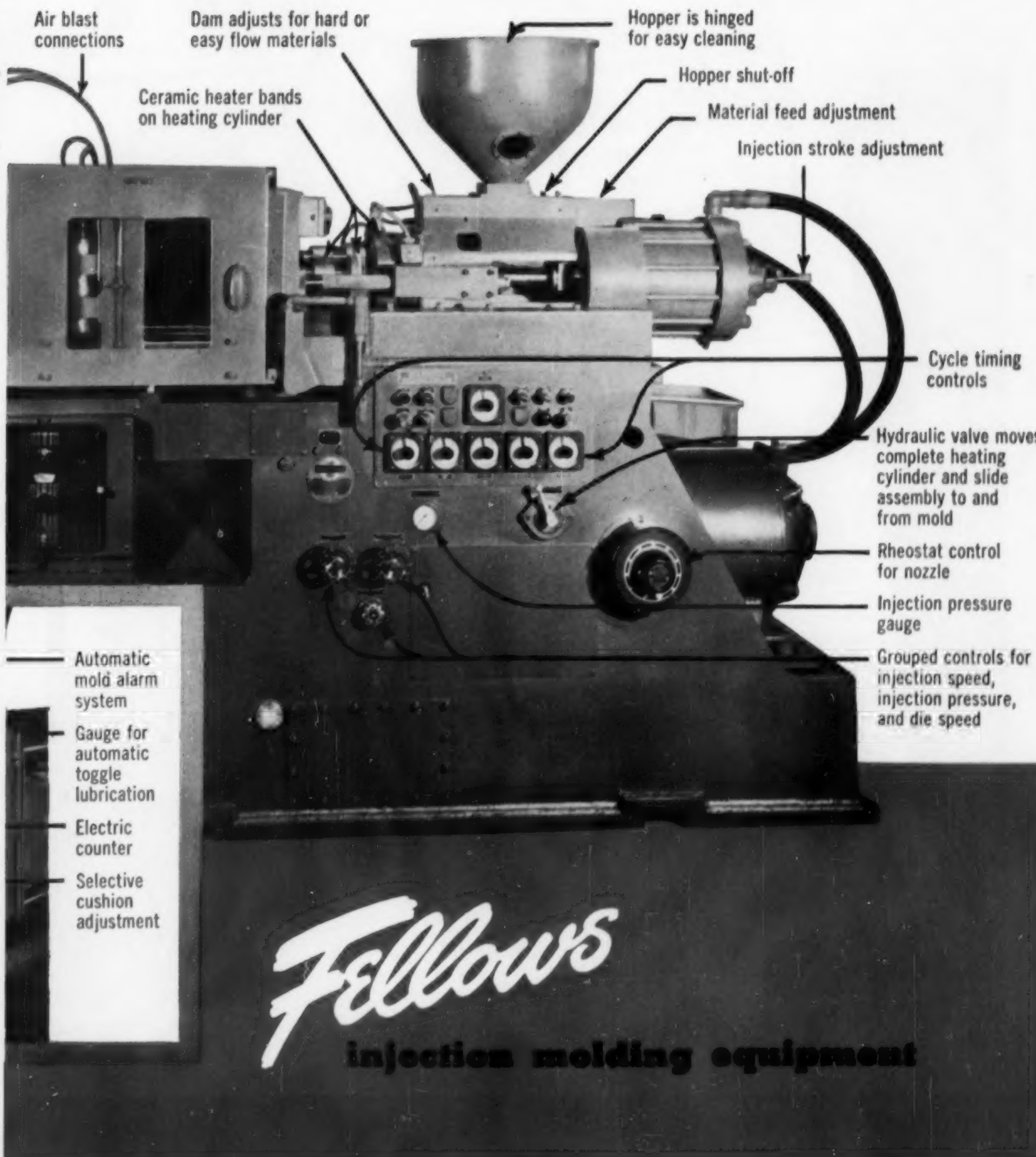
6214 W. Manchester Ave., Los Angeles 45

3-125 is out in front, too!



"Poly-Eth" Builds Markets For You:

More than 2,000 potential customers for polyethylene pipe were discovered by this Spencer Chemical Company advertisement in Time and Newsweek magazines. These people wrote for more information about the advantages of polyethylene pipe for farm, home and industrial uses. The result: many distributors reported marked sales increases.

"Market-building" is just one of the many services offered by Spencer, makers of "Poly-Eth"* polyethylene. For complete information on "Poly-Eth" resins, write us at 514 Dwight Bldg., Kansas City 5, Mo.

Poly-Eth
by
SPENCER

*A registered trademark of Spencer Chemical Co.

Polyethylene

AMAZING NEW USES FOR WONDER PLASTIC

Carol Goldsberry: "Now you can lead water to the horse."

When Carol Goldsberry of Runnells, Iowa, counted up and discovered he was hand-pumping and hand-toting water to the tune of 250 gallons or 84 pailfuls a day, he decided this was a poor way to spend his youth. So he hied himself to town and came back with five 300-foot lengths of one-inch pipe made from polyethylene, chemistry's new wonder plastic.

Goldsberry coiled a 300-foot length over his shoulder and strolled out to the farm's well. Then, as casually as a cowboy unlooping his lariat, he unwound the pipe into predug trenches, laying it slack to allow for expansion or contraction.

By nightfall he had not only laid all 1500 feet, but had completed connections to the pump, to his house, to the milk barn, to the milk shed and to the chicken house.

And, as Goldsberry explained to representatives of Spencer Chemical Company,* besides cutting out about four hours a day of back-breaking and foot-flattening labor, he is actually making money on his investment in polyethylene pipe.

For example, the addition of running water in his milk barn and milk house made it possible for him to be reclassified to the status of Grade A milk producer—a technical designation which doubled his income from his daily production of 40 to 60 gallons of milk.

*Makers of "Poly-Eth" polyethylene. "Poly-Eth" is a registered trademark of Spencer Chemical Company.

Salesman John Cowden and "Poly-Eth," Spencer's symbol for polyethylene.

PAVING THE PIPER. To his surprise, Goldsberry found that he had paid about one-third less for his one inch polyethylene pipe than he would have for one inch steel pipe. And, since polyethylene pipe can be purchased in 300-foot lengths (while the standard length of steel pipe is 21 feet) the time saving in couplings alone could be over 1400%. And pipe made of "Poly-Eth" will swing around obstacles and turn corners—another tremendous time and money-saver.

● Hard water had chewed away most of the steel pipe in his well, so Goldsberry replaced it with polyethylene pipe which is both acid-proof and alkali-proof.

Goldsberry's experience is a sample of why so many hundreds of people who could never have afforded metal pipe, are now flocking to install polyethylene pipe on a "do-it-yourself" basis.

FARMERS FASCINATED. So excited are farmers over this new kind of outdoor cold water system, that Harvey Moeckley, a director of the Iowa State Farm Bureau, recently was host to a Field Day on his farm near Polk City. The five-hour demonstration drew over 2000 people. And yet, polyethylene pipe is not new. Since 1947, Iowa Machinery and Supply Company alone has sold polyethylene pipe to over 1000 farmers.

FOR LAZY LAWN-OWNERS. Folks who like to watch other people work are praising the new permanent hidden polyethylene sprinkler system that lets you water your lawn from the hammock by turning one faucet on and off. To install the system, you just turn up the sod, lay the pipe in trenches 4" to 6" deep, attach the sprinkler heads and replace the sod. The sprinkler heads are concealed and out of the way when you mow the lawn. There's no need to worry if water freezes in the pipes, because polyethylene will stretch. One such kit, including 100 feet of pipe and eight sprinkler heads, sells for $39.95.

● Polyethylene pipe is a money-saver in coal mines, too. Because mine water contains strong acids and alkalies, it burns out the insides of metal pipe requiring frequent and costly replacements. Pipes made from "Poly-Eth" solve this problem because they're corrosion-proof. And since they're lightweight and flexible they can be put together in one-fourth the usual time.

PIPE-LINE TO PROFITS. If cold running water or flowing chemicals at low pressures are any part of your business, chances are polyethylene pipe can help you cut costs, add to convenience and increase profits. Our "Poly-Eth" Sales and Technical Service men will be happy to advise you.

FACTS FREE

If you'd like to know more about some of the remarkable new developments discussed in this "Poly-Eth" pipe report, check the items below in which you are particularly interested. We'll send you additional information by return air mail. Just mail this coupon to "Poly-Eth," Spencer Chemical Company, 514 Dwight Building, Kansas City 5, Mo.

☐ Farm Water Systems

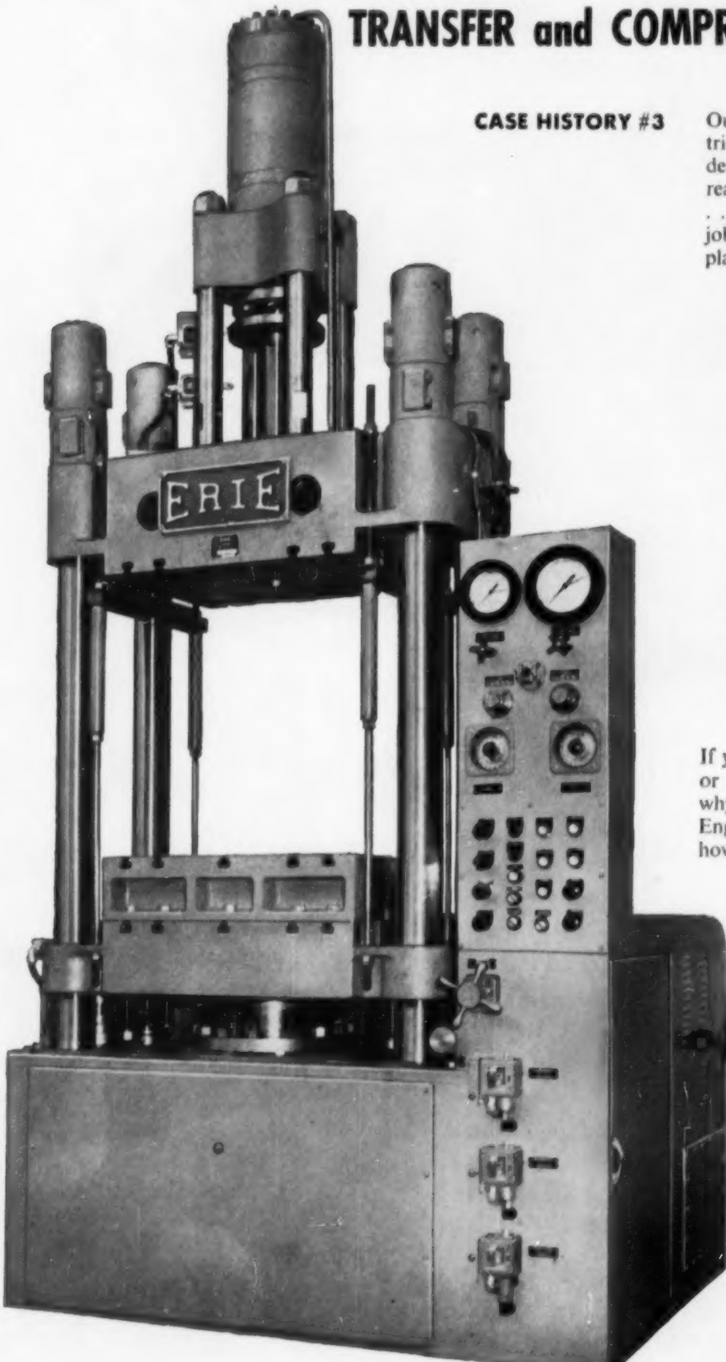
☐ Lawn Sprinkler Systems

SPENCER CHEMICAL COMPANY

514 Dwight Bldg., Kansas City 5, Mo., Manufacturers of "Poly-Eth" Polyethylene • Ammonia (Commercial and Refrigeration Grade) • Aqua Ammonia • 83% Ammonium Nitrate Solution • Synthetic Methanol • Formaldehyde • Hexamine • "Mr. N" Ammonium Nitrate Fertilizer • SPENSOL (Spencer Nitrogen Solutions) • FREZALL (Spencer Dry Ice) • Cylinder Ammonia.

ERIE PRESS OF THE MONTH

TRANSFER and COMPRESSION MOLDING PRESS



CASE HISTORY #3

Our customer, a prominent manufacturer of electrical machinery and components, asked us to design and build a flexible press which could be readily used for compression and transfer molding . . . a press to handle—at a profit—almost every job which might come into their rubber and plastic shop.

- Erie Foundry engineers designed this 200 ton self-contained transfer and compression molding press with controls for four different automatic cycles—two compression molding (with and without degassing), and two transfer molding cycles. In one transfer cycle, the transfer ram opens before the main ram. The transfer ram follows the main ram down and then returns during the second transfer molding automatic cycle. This press can also be set up and operated manually by means of an inching control.

- Both the 200-ton main ram and the 55-ton transfer cylinder have separate timers. Fast advance and return speeds are provided by two double acting cylinders. In addition, there are two knock-out cylinders on the bolster, and a mechanical knock-out for the top mold.

If you are thinking of a flexible, all-purpose press, or a compression press for a specific operation, why not call in the Erie Foundry Hydraulic Press Engineer? He will apply Erie Foundry's vast know-how to the design and building of your press.

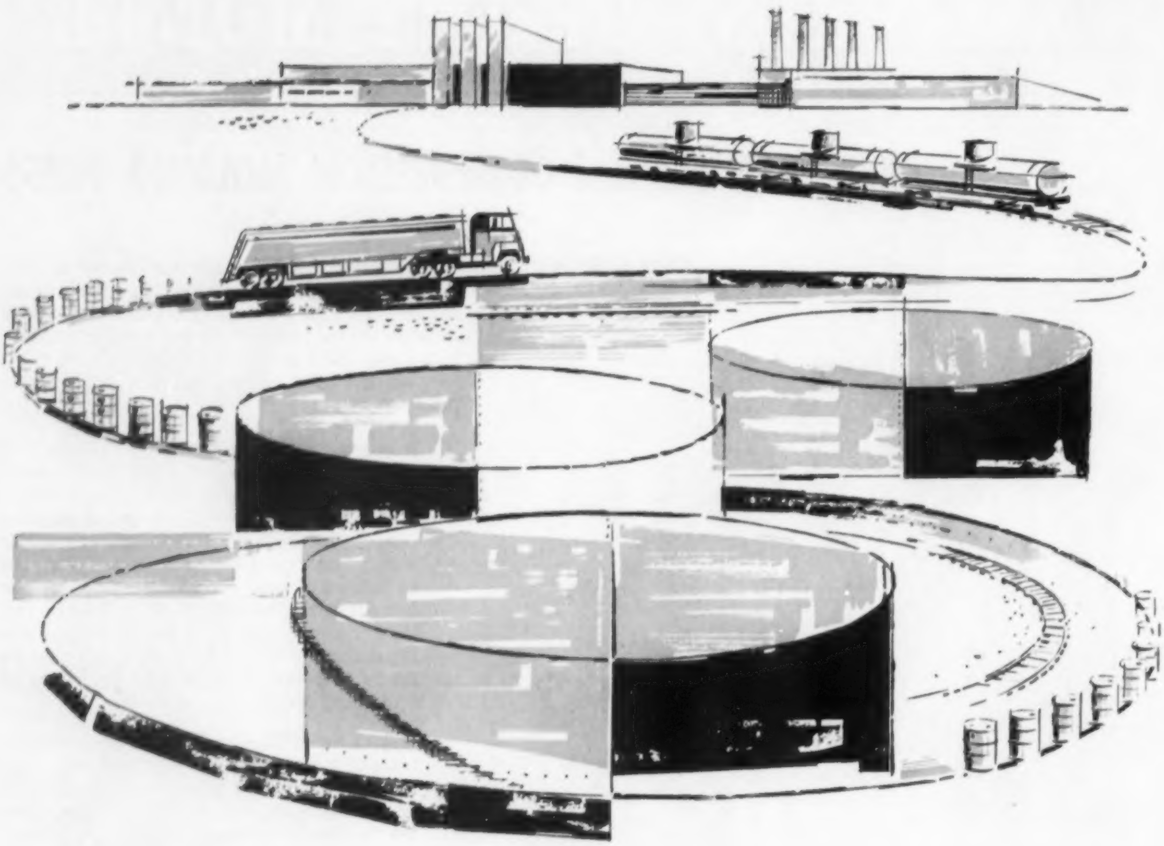
ERIE

SINCE 1895

Hydraulic Press Division

ERIE FOUNDRY CO.

ERIE, PA.



Now! Large Phenol, U. S. P. storage facilities near principal consuming points

To better serve Eastern and Midwestern Phenol users, Oronite has established bulk distribution terminals at key consuming points. This means large quantities of Phenol, U. S. P. in tank car, tank truck and drum shipments are quickly available from Oronite.

Why not get further information on Oronite's new Phenol distribution setup. Just contact the Oronite office nearest you.

ORONITE CHEMICAL COMPANY

"Basic Chemicals for Industry"

ORONITE CHEMICAL COMPANY

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20 North Wacker Drive, Chicago 6, Illinois
450 Mission Street, San Francisco 5, Calif.
Mercantile Securities Bldg., Dallas 1, Texas
Carew Tower, Cincinnati 2, Ohio
714 W. Olympic Blvd., Los Angeles 15, Calif.
36 Avenue William-Favre, Geneva, Switzerland

Save time, money, storage space with—

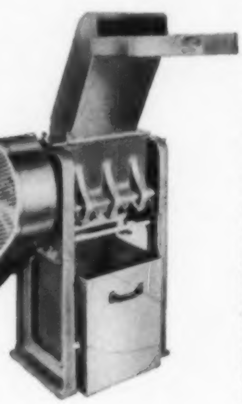
DE MATTIA GRANULATORS

PROCESS ALL YOUR SCRAP

With De Mattia Scrap Grinders in your molding shop you can reclaim all your scrap — large chunks from heating cylinders, accumulations from nozzles and real tough molded pieces — in your own plant, at once. Models for press-side installation save handling and make salvaged material immediately available. There is a De Mattia model for every scrap processing need.

WRITE FOR NEW ILLUSTRATED BULLETINS ON DE MATTIA GRANULATORS AND HIGH EFFICIENCY MOLDING PRESSES — Contain complete specifications on famous DeMattia molding equipment.

GRANULATOR No. 1



Simple, rugged and highly efficient. Has capacity of 200 lbs. per hour. 3 H.P. Motor with double V belt and Meehanite flywheel. Features high grade roller bearings with positive seal. Four cutting blades placed on a bias permit efficient cutting of thin strips in Vinyl, Saran, etc. Standard screen with ¼" openings (other screen sizes on request). Hopper opening 13¼" x 4½". Floor space required 32" x 44"; net weight with motor (approx.) 800 lbs.

GRANULATOR No. 3

For low-cost salvage of the large slugs and chunks resulting from cleaning out the heating cylinder, accumulation at the nozzle and also those molded pieces too tough for the average sprue and scrap grinder. Capacity — Over 150 lbs. per hr. 3 H.P. Motor in Base. Double V Belt Drive. Heat treated Alloy Steel Rotor High Grade Roller Bearings with Positive Seals. Standard Screens with 11/32" Openings (other sizes on order). Hopper opening 9" x 4¼".

GRANULATOR No. 4-A

Recommended for at-the-machine operation. Capacity 75 lbs. per hour; 2 H.P. Motor 1200 RPM; Direct drive; Solid semi-steel hopper; High grade roller bearings with positive seals; Standard screen with 11/32" opening (other sizes on order). Hopper opening 9" x 4¼". Overall dimensions 39" long, 18" wide, 42" high. Net weight 500 lbs. with base.

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CABLE ADDRESS, BROMACH, NEW YORK

DE MATTIA MACHINE and TOOL CO.

CLIFTON • NEW JERSEY

For precision and versatility—choose

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Birmingham	Alabama	Detroit	Michigan	New Orleans	Louisiana	St. Louis	Missouri
Boston	Massachusetts	Fresno	California	New York	New York	St. Paul	Minnesota
Buffalo	New York	Houston	Texas	Oakland	California	Salt Lake City	Utah
Charleston	West Virginia	Indianapolis	Indiana	Oklahoma City	Oklahoma	San Francisco	California
Charlotte	North Carolina	Jacksonville	Florida	Omaha	Nebraska	Seattle	Washington
Chicago	Illinois	Kansas City	Missouri	Peoria	Illinois	Toledo	Ohio
Cincinnati	Ohio	Los Angeles	California	Philadelphia	Pennsylvania	Yakima	Washington
Cleveland	Ohio	Louisville	Kentucky	Pittsburgh	Pennsylvania		

Pacific Coast headquarters, 350 Sansome St., San Francisco; Plants at San Jose, Calif.; St. Charles, Ill., and Glassboro, N. J.

OWENS-ILLINOIS PLASTICS
AN (I) PRODUCT

OWENS-ILLINOIS
GENERAL OFFICES · TOLEDO 1, OHIO

Its "drape shape" was what did it!

**when it comes to molding—
nothing "gets in the groove"
like Bigelow Fiber Glass!**

BIGELOW
Fiber Glass Products

In a word, that's why the Apex Electrical Mfg. Company of Cleveland, Ohio chose Bigelow Fiber Glass for its Foldaway washing machine. Apex required a glass mat that could drape easily, form around corners, fill in curves and crevices, eliminate the need for pre-forming. A mat that would result in a decorative, durable work surface lid . . . a splash guard that would not chip, rust, warp, stain or corrode.

Apex needed a uniform, flexible, form-fitting mat that could meet these specifications exactly—and they got it with Bigelow FORMAT*!

*A Bigelow Trademark.

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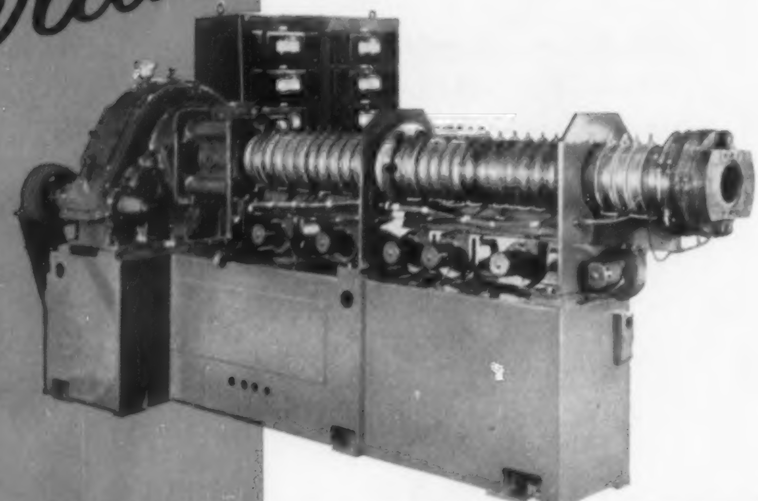
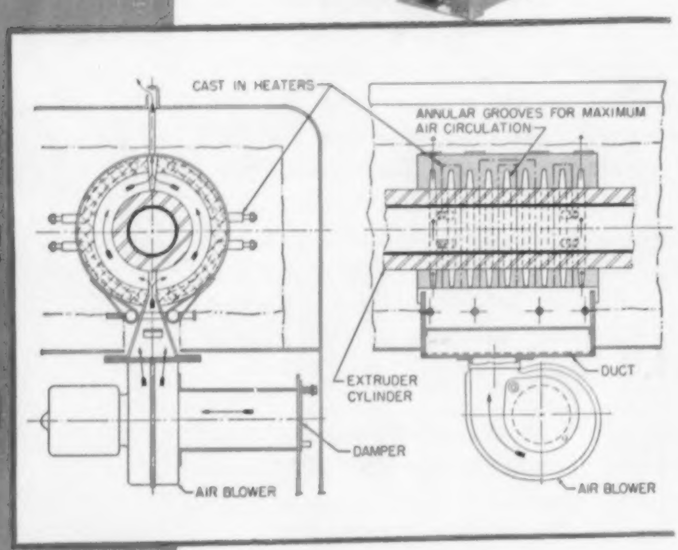
Distributed in Canada by Dominion Rubber Company, Ltd., Textile Division, Kitchener, Ontario

Closer tolerance



PLASTIC EXTRUSIONS with NRM



"Balanced HEAT CONTROL"*...

THE MOST PRACTICAL, ECONOMICAL AND PRECISE WAY TO CONTROL HEAT IN EXTRUDER CYLINDERS

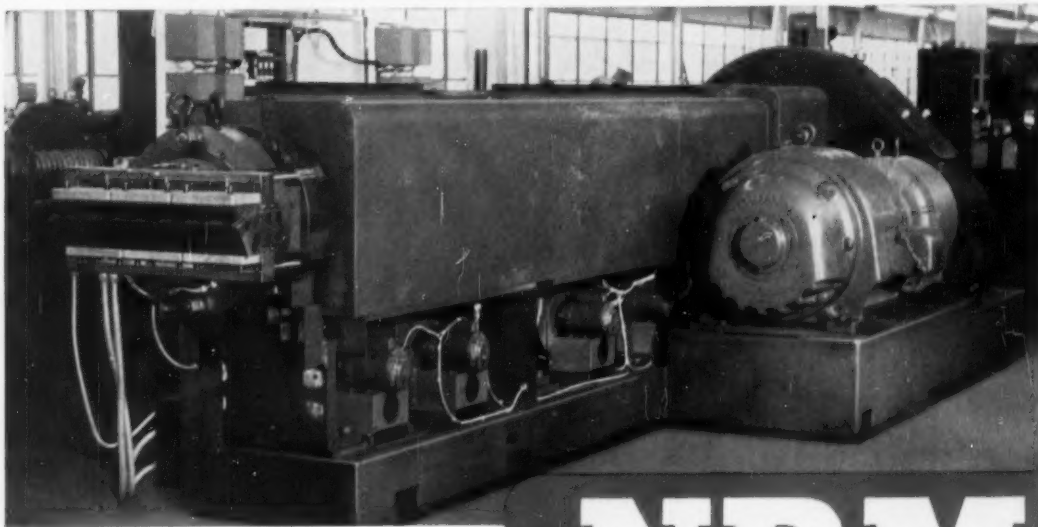
NRM Electrically Heated Thermoplastics Extruders with "Balanced Heat Control" were the *first* machines to give the plastics industry truly accurate control over frictional heat. By balancing operating heat with the temperature of the extruder, Balanced Heat Control virtually eliminated "pulsation" at the die and greatly increased dimensional accuracy of the extrusions.

Today, NRM's Balanced Heat Control is *still* the most effective and efficient method of controlling frictional heat, and because of refinements made over the years, it is now even more efficient than ever. Here are a few reasons why:

It's EFFECTIVE . . . because it is located between the two opposing sources of excess heat, namely the heat of the compound, and the heat inertia of the heating elements after the current has been cut off by the controls. It's accurate, it's simple, it gives complete, positive heat control.

It's SELF-CONTAINED — The system consists of a series of deep slots cut into half-circle aluminum castings which enclose the full length of the cylinder, thus forming inverted fin-shaped channels through which high volumes of air are passed at low pressure. The slots do not interfere with conduction of necessary working heat, yet provide a maximum area for the radiation of excess heat. Balanced Heat Control is also used to cool the Extruder rapidly for shut-down. The entire Balanced Heat Control mechanism is contained in the Extruder, with the push-button controls being in the Control Cabinet. With no expensive nor complicated connections to compressed air, steam, oil or water systems, it is the most compact extruder heat control mechanism in use today.

It's ECONOMICAL — NRM's Balanced Heat Control costs little to operate. Its only power requirement is electricity for blower motors, of which there is only one to each heating zone. Its economy, together with the better quality and more *accurate* extrusions it makes possible, are just more of the many PLUS reasons why NRM Extruders with exclusive Balanced Heat Control assure a higher ratio of profit from thermoplastics extrusion.



LET US TELL YOU MORE...

If you are planning the purchase of plastic extruders and equipment, we'll be happy to send you details and illustrated information on the NRM *full* line. There's an NRM Extruder with matched accessories to meet every requirement.

* NRM PATENTED FEATURE

2541-1

NRM

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Take a leaf out of our new Lantuck book

Learn how Lantuck non-woven fabrics can cut your cost, improve your product in coating, laminating, "plumping."

Learn of Lantuck's versatility in calender coating, laminating to film, electrical heat sealing and high pressure laminating.

FOR FREE COPY of new book explaining the unique advantages of Lantuck non-woven fabrics, write Lantuck Department M8.

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IC Vynafoam*

FOR GASKETING OR INSULATION WITHOUT MOLDS

Foams in place at atmospheric pressure!

For gasketing, thermal insulation, sound deadening and vibration dampening, IC Vynafoam provides a uni-cellular, medium density (15-30#/cu. ft.) flexible foam with low water absorption, and high tensile strength.

The entire operation is simplicity itself! You need no molds, no expensive equipment—only a circulating hot air oven that operates at 325°F. to foam the product in place at atmospheric pressure.

IC Vynafoam produces definite savings by eliminating such time-consuming operations as cutting gaskets or insulation to desired size and shape, placing them with adhesives, and applying pressure till set. This ease of application results in increased production with a reduction of labor costs!

Ask your nearest IC Technical Specialist to show you how IC Vynafoam may produce great savings for you.

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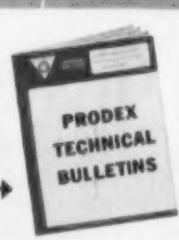
PRODEX

For
Higher Output
Closer Tolerances
Faster Start Ups
Lower Maintenance

PRODEX EXTRUDERS

"PACKAGE" INSTALLATIONS FOR
Pipe, Sheet, Film and Compounding



Get bulletins today →

Economics Dictate Prodex Extruders

Through years of continuous operation, Prodex Extruders have proven that they produce more pounds per hour of better quality extrusions.

Available with Le/D ratios of 16:1, 20:1 and vented 24:1 in 2½", 3½", 4½", 6" and 8" sizes. Get the full facts. New technical bulletins No. E-2 and E-3 provide full details.

Let us demonstrate to you the superior performance of Prodex Extruders

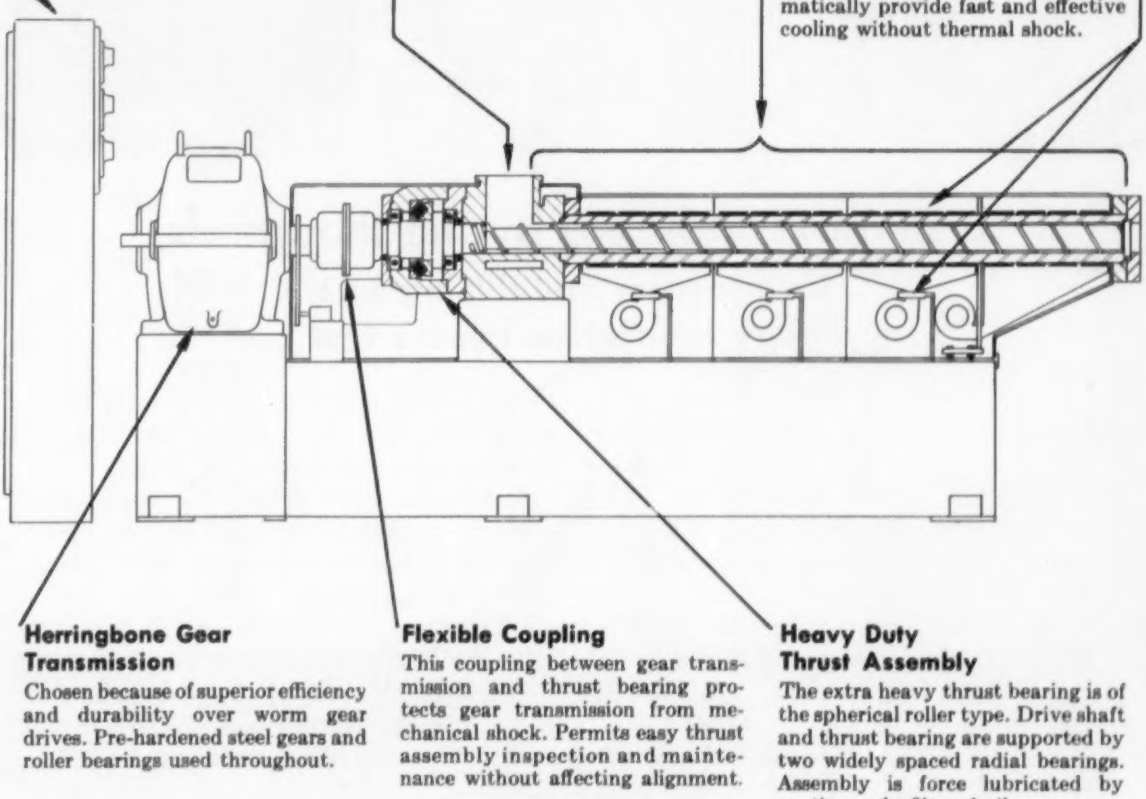
Creative engineering and 20 years of extrusion experience make Prodex the best extruders you can buy. Prodex performance is made possible by this exclusive combination of advance design features.

Completely Wired Control Cabinet
Contains all temperature controllers, individual zone ammeters, contactors with pilot relays, individual fuses for each circuit. Built to strict JIC standards with harness wiring and terminal strip construction. Gasketed and dustproof.

Le/D Ratio of 20:1
Produces extrusions of superior appearance to closer tolerances and 20% to 40% faster. Advanced screw and barrel design guarantee maximum drag flow and pumping action.

Extra Large Feed Opening
No compound bridging.

Fully Automatic Thermo-Control
Electronic three position temperature controllers automatically actuate stainless steel heaters and turbo air coolers for precise temperature control. Triple density heaters permit choice of wattage density best suited to operation to avoid hot spots. High capacity blowers automatically provide fast and effective cooling without thermal shock.



Herringbone Gear Transmission
Chosen because of superior efficiency and durability over worm gear drives. Pre-hardened steel gears and roller bearings used throughout.

Flexible Coupling
This coupling between gear transmission and thrust bearing protects gear transmission from mechanical shock. Permits easy thrust assembly inspection and maintenance without affecting alignment.

Heavy Duty Thrust Assembly
The extra heavy thrust bearing is of the spherical roller type. Drive shaft and thrust bearing are supported by two widely spaced radial bearings. Assembly is force lubricated by continuously filtered oil.

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Brilliant Escutcheons by the thousands

CVC vacuum metallizing fills heavy production quotas fast

"We are already operating at four cycles an hour with our new *CVC* coater," writes Charles E. Catalde, President, Buffalo Molded Plastics Inc. . . . "When we're ready for increased production, I'm sure we can add another complete cycle without any trouble."

The *CVC* vacuum coater Mr. Catalde speaks of gives a chamberful of parts a brilliant metallic luster in a matter of minutes.

And it doesn't require a skilled operator—a few hours' experience in the use of the machine trains any of your help to turn out flawless pieces in large quantities.

The operator simply inserts racks of lacquered parts into the vacuum chamber, valves in the roughing pump for initial evacuation, and then opens the high-vacuum valve to the diffusion pump.

In seven or eight minutes the chamber pressure reaches the desired level and the operator flashes the filament which evaporates the aluminum. Immediately the aluminum begins to condense on the parts. It's easy. It's inexpensive.

Our sales engineers will be glad to share their experience in vacuum metallizing and associated lacquer operations to help you set up your own system. They will also help you decide which type and size coater best meets your needs.

Write for technical data—Vacuum Coaters—on the complete *CVC* line.

Consolidated Vacuum, Rochester 3, N.Y.

a division of CONSOLIDATED ELECTRODYNAMICS CORPORATION, *Pasadena, California*

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You too will congratulate yourself for using:

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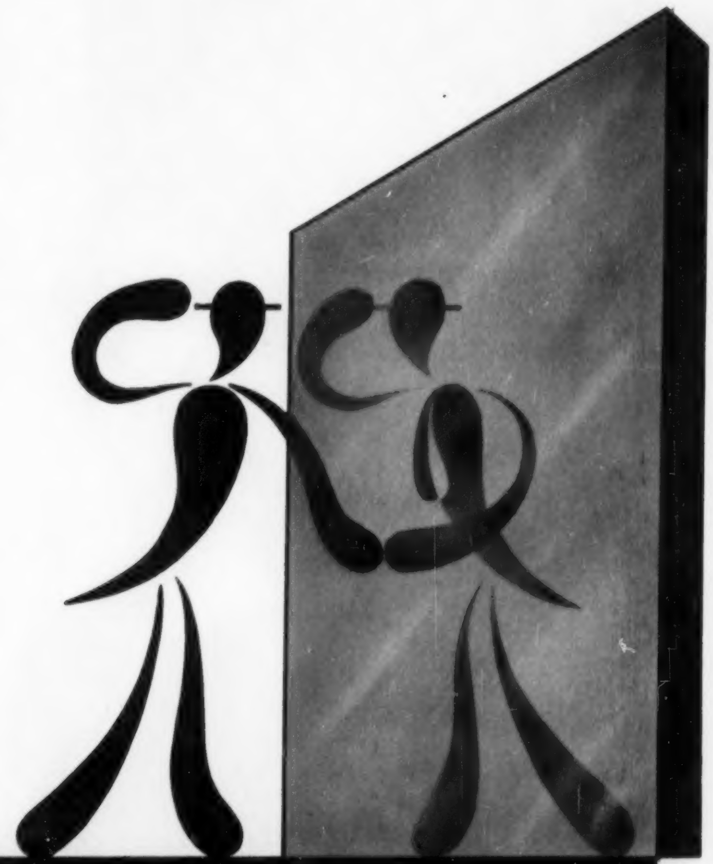

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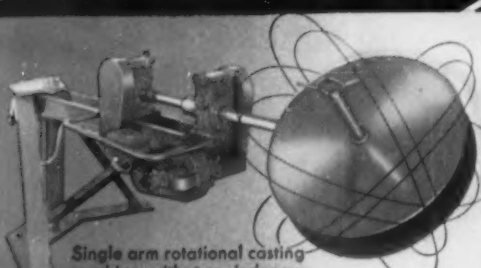
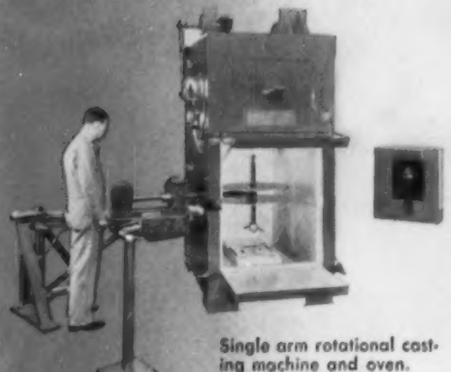
As whitening, brightening and opacifying agents, nothing can surpass TITANOX titanium pigments for adding eye-appeal to plastics. Titanium Pigment Corporation (subsidiary of National Lead Company), 111 Broadway, New York 6, N. Y.; Atlanta 5; Boston 6; Chicago 3; Cleveland 15; Houston 2; Los Angeles 22; Philadelphia 3; Pittsburgh 12; Portland 14, Ore.; San Francisco 7. In Canada: Canadian Titanium Pigments Limited, Montreal 2; Toronto 1.

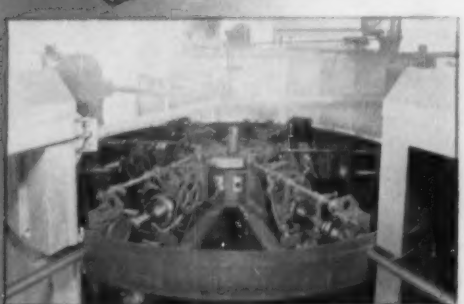
Announcing ...



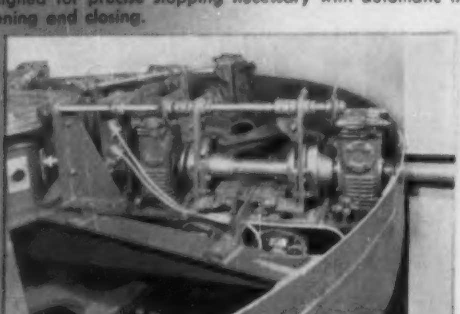
Single arm rotational casting machine with two independent variable speed drives. Automatic positioning of mold wheel for convenient mold servicing.



Single arm rotational casting machine and oven.



Multiple arm casting machine showing separate drive, clutches and brakes for mold rotation in each of the two planes. Designed for precise stopping necessary with automatic mold opening and closing.



Turntable style with six arms. An additional six arms can be added for a total of 12.

Significant Advance for Plastic Production

Machines engineered and built to your specific requirement. Following are some of the features built in our SPECIAL MACHINES.

Two groups of molds per arm, arranged for simultaneous rotation around two axes perpendicular with each other.

Two separate and variable speed drives rotate the molds around each axis. This action controls wall thickness for different product shapes.

Movement of arms is indexed for stop and go—not a continuous movement. Stopping time in oven or at the mold's service position can be varied.

Rotation of molds can be automatically stopped or started at service position and oven entrance.

Molds are automatically positioned for convenient opening, stripping, filling and closing.

A 30-inch diameter mold area allows a large range of mold sizes and flexibility of arrangement.

Arms, oven units and service stations can be added to increase capacity and mold servicing.

Sales and Engineering by

HALE and KULLGREN, INC.

P. O. Box 1231 · AKRON, OHIO

MANUFACTURED BY

THE AETNA-STANDARD ENGINEERING CO., PITTSBURGH, PA.

PLANTS IN WARREN, OHIO · ELLWOOD CITY, PA.

color-full rez-n-dye

For maximum **UNIFORMITY** *and* **LIGHT STABILITY**

For consumer sales appeal or for industrial identification . . . for novelty effects or for practical applications . . . REZ-N-DYE is the world's finest and fastest external coloring agent for plastics.

Whether you use the cold-dip, hot-dip, brush, swab or spray method—Schwartz Chemical research laboratories have created an efficient REZ-N-DYE for each purpose. And, if your particular operation calls for a special application, chances are Schwartz can create a process to achieve your objective.

Transparent colors ranging the full length of the visible spectrum, are custom-matched for your individual requirements and for fashion promotions. For metallizing—Copper, 14K Gold, Antique and Brass are available to fill your particular specifications. Tortoise shell and other interesting effects are readily achieved with versatile REZ-N-DYE.

For colorful quality products, always specify REZ-N-DYE . . . often copied but never equalled.

If you have a plastic problem, contact our research laboratories. There's no obligation. Solving plastic problems is an integral part of our service.

Serving the needs of the plastic industry

schwartz

CHEMICAL CO., INC.
328 West 70th St.
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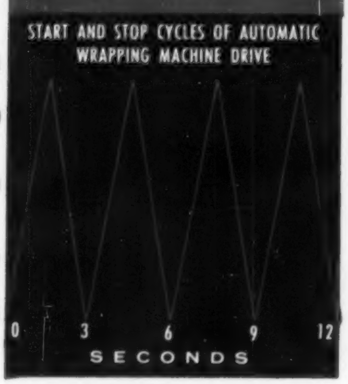
MANUFACTURERS OF DYES—LACQUERS—CLEANERS—ADHESIVES—EXCLUSIVELY FOR PLASTICS

20 ROLLS OF "SARAN WRAP" EVERY MINUTE



RELIANCE V★S DRIVE ®

The Dow Chemical Company's production of "Saran Wrap" has leaped from 130,000 rolls to 4,000,000 rolls a month since 1951. This up-swing is due to a new plant, a new flow system, and additional equipment including new machinery equipped with Reliance V★S Drives.

One of the most dramatic applications of V★S Drives is on the final wrapping machines shown here. The drives must be able to start, accelerate to 3500 rpm., and stop more than 20 times a minute.

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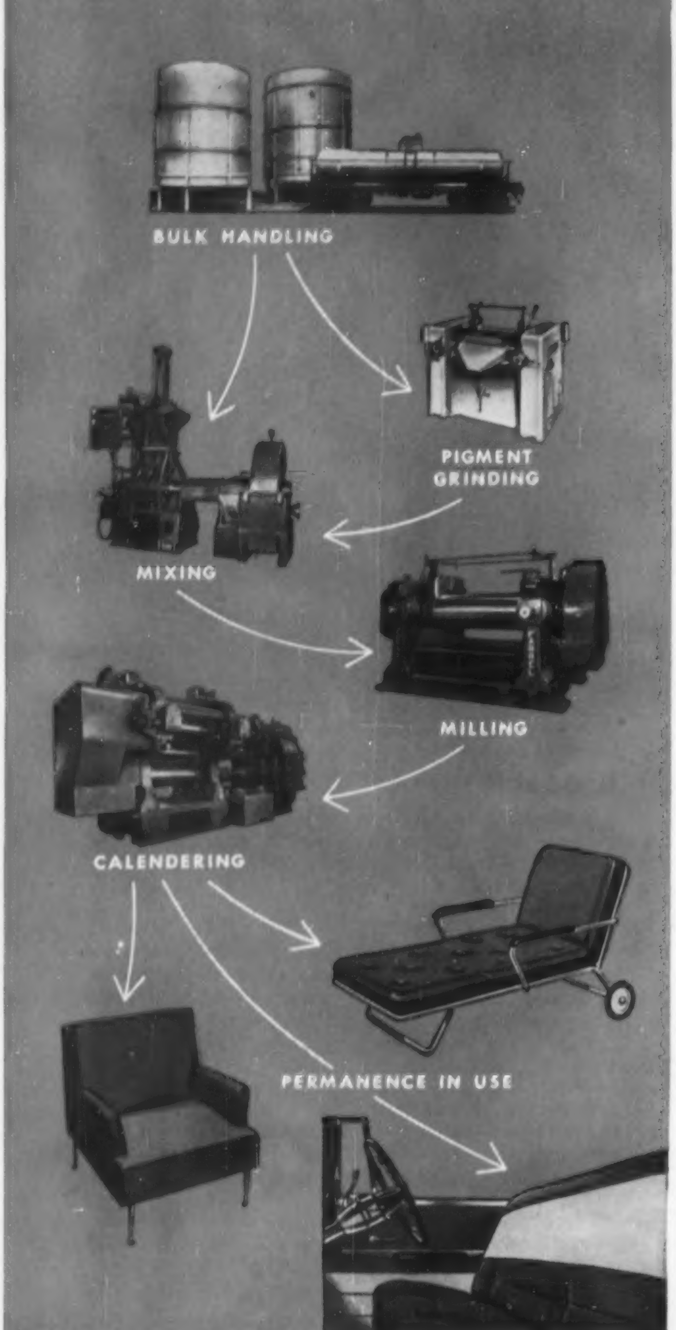

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MODERN PLASTICS
Volume 33
August 1956
Number 12

Reinforced molding compounds

Part 1: polyesters and alkyds — outstanding advantages spur spectacular growth

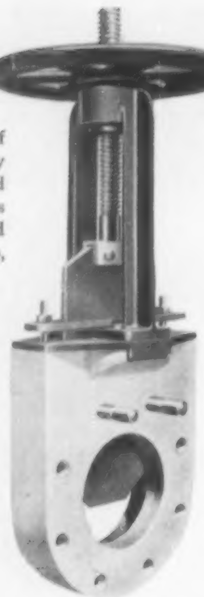
Easy-to-handle shape of extruded premix (circle) facilitates mass production of auto parts. (Photo, Rohm & Haas and Woodall)

Although reinforced molding compounds are not new to the plastics industry, recent developments in production techniques and refinements in resins and reinforcing materials have opened exciting new opportunities for them in large-volume industrial and consumer applications. In this two-part survey these developments will be reviewed and their possible effect on potential markets evaluated.

The first half of the survey, which begins here, deals with the reinforced polyester and alkyd molding compounds (popularly referred to as premixes)—the newest and fastest growing of the compounds.

The second half of the survey, which will appear in the September 1956 issue of Modern Plastics, will deal with the other reinforced thermoset molding compounds, including the phenolics, melamines, and silicones.

By the end of 1958, one leading supplier of polyester resins confides, it is probable that the amount of polyester going into reinforced molding compounds may be between 15 and 20 million lb. a year—better than half the amount



Valve body molded of polyester-glass effectively stands up to chemicals and wide temperature extremes encountered in pulp and paper industry. (Photo, Thermaflow Corp.)

Good electrical properties, high temperature resistance, light weight, and high impact strength are offered by molded reinforced polyester parts for welding electrode holder. (Photo, Plumb Chemical)

Savings and improved performance achieved by Chrysler in design of polyester-sisal heater housing have stimulated interest by other car makers

consumed by the *entire* reinforced plastics industry, including preform and mat molding, in 1954. Yet this infant offspring of the reinforced plastics industry has only started to get off the ground *within the past three years.*

To back up this optimistic outlook, suppliers point to the industries that are swinging production of growing numbers of component parts over to molded reinforced polyester or alkyd compounds. At one point during the record production year of 1955, Chrysler alone was estimated to be consuming about 1½ million lb. of premix materials (approximately 400,000 lb. of polyester resin) a month. If every other automobile company swung over to a major use of the material—and most have already started on a small scale—it is conceivable that this industry alone would be able to account for the entire 20-million-lb. figure by 1958.

Similarly, the electrical field has grown to the point where it is now annually consuming well over 1½ million lb. of polyester and alkyd resins for applications based on the reinforced molding compounds.

And in other fields, new product possibilities, ranging from appliance handles to phonograph housings, are being developed which promise to increase consumption even further.

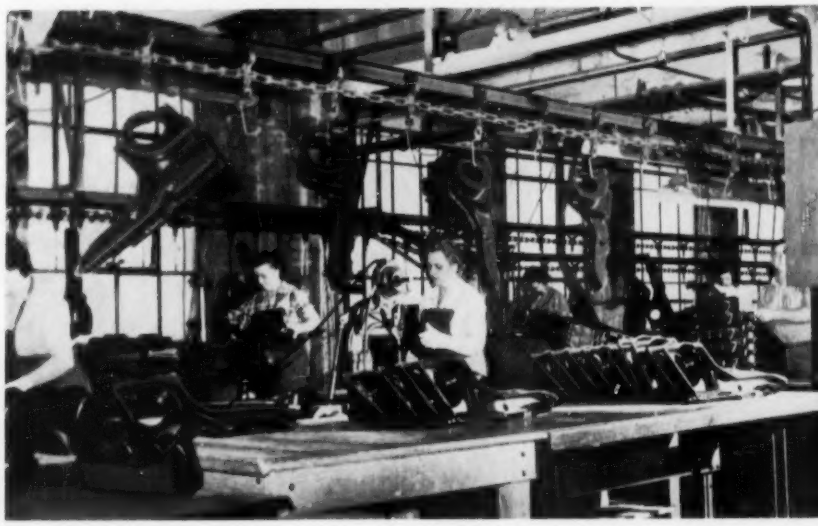
Compounds and premixes

In the great majority of these applications, the reinforced polyester compounds and premixes are being used in market areas where no other plastics had been used before. The materials are either replacing metal—particularly assemblies fabricated from steel stampings—or are going into newly created jobs.

As such, there is much that has to be done to clarify the position of these new materials in the make-up of the plastics industry and much that has to be learned about how they should be handled and how they can best be applied to make the most of their unique qualities.

Basically, the reinforced polyester and the reinforced alkyd molding compounds are made up of resin, reinforcing fiber, filler, and other ingredients, all combined into a putty-like mass prior to molding. Since for all practical purposes, the term alkyd is generally applied to a fatty acid-modified polyester, the two types are usually classified under the same heading. For purposes of simplification, the term reinforced polyester molding compound will be used in this article to cover both types.

Reinforcing fibers for the compounds are in the form of short, chopped strands and can be

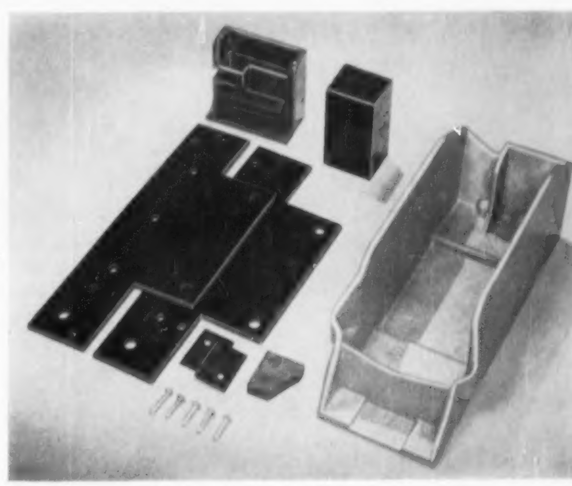


Finishing room to which molded automotive parts are conveyed is last stop in continuous production line set-up. (Photo, Rohm & Haas and Woodall)

either glass, sisal, asbestos, or one of the synthetic fibers. Common to the compounds is the manner in which they can be molded by conventional compression or transfer molding techniques.

Because of their putty-like form, these compounds were originally called "gunk molding compounds"—a rather unpleasant name and one which, in view of the strides being made today in improving the handling qualities of the material, was a particularly unfair description. The more appropriate name of "premix" was then coined to distinguish the compounds from preform and mat molding in which mat and cloth are used and in which the resin and reinforcement are generally brought together at the time of molding.

More recently, trade usage seems to have relegated the term *premix* to those molders, e.g. Woodall Industries, Inc., Detroit, Mich., and The Glastic Corp., Cleveland, Ohio, who independently buy resin, reinforcing fibers, fillers, etc., and mix the compounds on their own premises; the term *reinforced polyester molding compound* is generally applied to the combination of resin, fiber, filler, etc., supplied to molders already mixed and ready for use. In this latter category are companies such as Plaskon, Barrett Div., Allied Chemical and Dye Corp., New York, N. Y. (an alkyd-type compound); Thermaflow Chemical Corp., Tunkhannock, Pa.; Plumb Chemical Corp., Philadelphia, Pa.; Glaskyd, Inc., Perrysburg, Ohio (an alkyd-type compound); and Flexfirm Products, El Monte, Calif.



One-piece molded polyester-glass circuit-breaker support (right) replaces seven separate parts (left). (Photo, Glastic)

Just how much compound is being mixed on the molder's own premises and how much is being supplied to molders already mixed is difficult to determine. One thing certain, however, is that the suppliers of reinforced polyester molding compounds, most of whom are relatively recent entries in the field, have shown phenomenal growth in their short history. Eventually, these suppliers feel that they will capture the bulk of the business. To back up this contention, suppliers claim that unless volume is large enough (as in Woodall's jobs for the automotive industry), molders cannot gear up for the research work and consistent

Automotive applications, ranging from air conditioning and heater ducts and housings to side seat shields and door panels, stand out as the largest volume market for sisal- or glass-reinforced polyester molding compounds. (Photo, Rohm & Haas and Woodall)

quality control which is necessary for the proper mixing of compounds to rigid manufacturing specifications. Since fibers, fillers, and resins can be combined in any one of a number of different combinations to fit specialized requirements, a good deal of engineering know-how has to go into the compounding of premixes. Moreover, limited shelf life raises problems unless the company can use the material almost as fast as it turns it out.

On the other hand, of course, molders point to the many cost advantages inherent in mixing the compounds on the premises and several of the larger custom molders and even some of the captive shops (e.g. Westinghouse) feel that such savings have been largely responsible for the development of so many new applications. But suppliers claim that if the expansion in sales of molding compounds continues at its present rate, overhead costs will be spread out more, bringing the compounds into a more favorable price position. Suppliers also claim that dependence by molders who mix their own compounds on only one or two really large-volume jobs constitutes a serious limit on potential expansion.

Advantages and limitations

But no matter whether the material is mixed on the premises or not, the production advantages to be obtained from using the reinforced polyester molding compounds are many: 1) the compounds offer a means for making reinforced plastics parts with less critical requirements at considerably lower cost than by mat or preform molding; 2) complicated parts which incorporate slots, grooves, bosses, and even molded-in inserts, can be economically molded in one piece; 3) shorter press cycles using conventional compression and transfer molding equipment are possible (pieces can be turned out in ½ to ⅓ the time required for wet layup); 4) correct charges of material can be weighed out more accurately, thereby reducing flash and waste; 5) the proportions in which resin, fiber, filler, etc., are mixed together can be con-

trolled more closely to meet rigid specifications; 6) since the reinforcing fiber need be only in its simplest form (chopped strands), a greater variety of fibrous materials can be used; and 7) these various fibers can be mixed with a wide range of resins, fillers, etc., in varying proportions to provide cost advantages and specialized properties to meet specific application requirements.

In the latter area, in particular, users of molding compounds and those molders who mix their own are faced with the problem of selecting the proper ingredients to serve their special needs. Glass fibers, because of their high impact strength and other desirable physical properties, are the largest-volume material and have found extensive use in electrical applications, some automotive parts, housings, tool handles, and appliance components, among others. More recently, sisal fibers have moved into prominence as a volume material, with the automotive field as its prime outlet. Sisal fibers are cheaper than glass, but because their physical property values are considerably lower, they are recommended for use only in those applications where exceptionally high structural strength is not required and which do not have serious moisture or weather resistance requirements. Asbestos fibers, offering heat and flame resistance, high strength at elevated temperatures, and good electrical properties, have also started to move into the field of premixes. And the synthetic fibers, primarily nylon, Dacron, and the acetates, are now being researched for

Preparation of reinforced molding compound begins with pouring of polyester resin into mixer along with other ingredients.

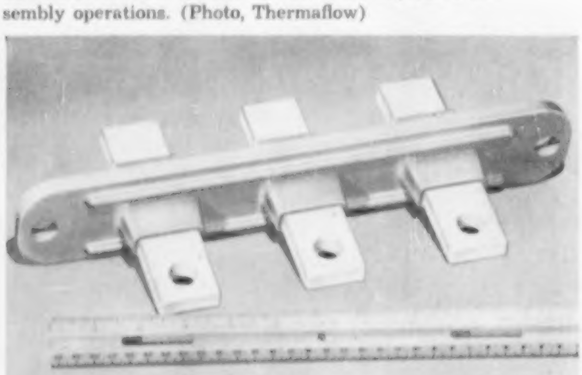
After thorough blending of batch, chopped strands of fibrous glass are added. (Photos, Fabricon Products & Allied Chemical)

Compound, in loose form, is weighed out and shaped into rough preform by hand, then inserted into mold in conventional compression press. (Photo, The Glastic Corp.)

highly specialized applications where cost is not a factor. Thermaflow, for example, supplies a nylon-reinforced molding compound which is being used by Sound-Craft Systems for molding a battery housing for one of their electronic megaphones. In addition to the high degree of abrasion resistance obtained by using the nylon-reinforced molding compound (which reduces the hazard of scratching in transit), the housing has a smooth and attractive surface finish and is more compact, sturdier, and weighs 2½ lb. less than the metal model which was previously used. Switching to the reinforced compound also affected a 20% savings in materials costs and a 25% savings in assembly costs.

Lightweight, rugged outlet box molded of polyester-glass premix is unaffected by moisture or corrosive atmospheres. (Photo, Porcelain Products)

Molded-in bus-bars in heavy-duty reinforced plastic circuit-breaker contact cut down on expensive assembly operations. (Photo, Thermaflow)



The type of monomer going into the polyester resin also has a bearing on the manner in which the reinforced compound or the premix will be used. Because of the heat generated and the surface area exposed during the mixing operation, the volatility of the monomer, in particular, affects storage life. At the present time, the three monomers generally used in the premix resins are diallyl phthalate, vinyl toluene, and styrene.[1]

Redesigning a part

Despite all the advantages, however, reinforced compounds are not a panacea for all the ills of industrial design. Like other materials, they have their shortcomings and must be used judiciously to obtain the best results.

Most companies working with the polyester compounds and premixes point out that molded parts cannot be substituted directly for existing metal, porcelain, or other non-plastics parts. Since premixes and compounds have their own special characteristics, the part must be redesigned along new lines to get the most out of them. The strength factor, for example, must be taken into consideration. The strength of a molded glass-reinforced polyester premix piece is 65 to 75% as much as that of a fibrous glass mat molding and about 65% as much as a metal die casting. (In making comparisons with metal castings, however, it should be noted that forces exceeding the impact strength of a casting will completely crack it, whereas excessive stresses on a molded premix application will generally cause only local cracking.) Consequently, redesigning a part for reinforced polyester premixes calls for building up highly stressed areas by molding thicker wall sections where added strength is needed.

Unfortunately, however, a body of specific engineering data relating to the reinforced polyester molding compounds and premixes has not yet been built up. The expanding use of the materials within the next few (*To page* 194)

[1]For more detailed discussions of the ingredients of reinforced polyester molding compounds and premixes and the effect they have on end properties, the following articles are recommended: "Reinforced Polyester Premixes," by W. O. Erickson and W. R. Ahrberg, Modern Plastics 33, 125 (Nov. 1955); "Highly Filled Fibrous Glass-Reinforced Polyester Molding Compound," by R. F. Shannon and L. P. Biefield, Modern Plastics 33, 133 (Nov. 1955); and the papers on molding compounds and premixes presented at the 11th Annual Meeting of the Reinforced Plastics Div. of S.P.I. in Atlantic City.

Styrene machine gun shoots styrene bullets

Authentic replica of the real thing, molded impact styrene toy machine gun delights youngster, takes play-time abuse without damage

In selecting the most appealing toy from the wide range available to them on dealers' shelves, children generally exhibit a decided craving for realism—much to the satisfaction of molders of plastics toys. Through the use of plastics, manufacturers can economically mold into most any type of toy all the minute and authentic details that children so frequently demand.

One example of the extent to which this emphasis on realism can go is a recently introduced molded styrene toy machine gun—an almost exact scale replica of the famous .50-calibre air-cooled machine gun. With the exception of the aluminum tripod legs on which the gun stands and the aluminum barrel, the toy is made entirely in plastics. There are 17 precision molded high-impact styrene parts (with a total weight of about 1¾ lb.) that go into the assembly of the gun proper; the gun belt, which realistically feeds off the magazine into the firing chamber, is vacuum formed of high-impact styrene sheet; and even the harmless, lightweight pellets which the gun "fires" are injection molded of regular styrene, mixed with a luminescent pigment that glows in the dark to simulate tracer bullets.

Achieving a high degree of authenticity in the toy, while still keeping it in the popular price range, necessitated engi- (*To page* 209)

Precision-molded parts of gun include (top portion of photo below) magazine sections, tripod bases and swivel, barrel end, body, handle, and other parts; belt is vacuum formed; bullets (above belt) are luminescent styrene

Thermoset plastic with embedded marble chips makes attractive table top for summer furniture. (Photo, Monsanto)

Elegance of twin chests and vanity is accented by tops of stain-resistant, washable white melamine decorative laminate. (Photo, Monsanto)

Plastic-surfaced plywood gives do-it-yourself and professional carpenters an easily worked material for built-in furniture, custom-made cabinets. (Photo, Crown-Zellerbach)

Sturdy desk top, chair seat, and chair back are molded of resin-bonded granular wood. (Photo, Monsanto)

Why plastics

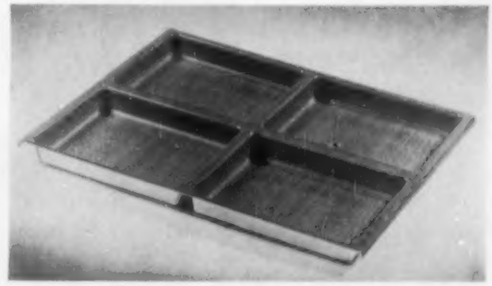
Tops that won't stain,
drawers that won't stick,
lifetime upholstery, sagless padding,
and an endless variety
of beautiful effects are offered
—with great production economies

Retail sales of furniture through regular outlets in 1955 racked up a total of approximately $4,612,000,000, according to Department of Commerce figures. "The Business Outlook for 1965"[1] estimates that annual expenditures for furniture will be running about $5.9 billion by that year.

The plastics industry has an increasingly large stake in the furniture field. New materials, improved formulations, and advanced production techniques have given the designer and the furniture manufacturer increased latitude of styling and construction. In an age when soaring labor costs have virtually outlawed a high degree of hand craftsmanship for most

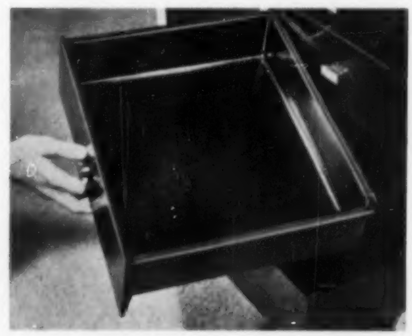
[1]A brochure prepared for subscribers to "Report on the Business Outlook," a private weekly bulletin for the business executive, published by Business Executive Publications, a division of The Bureau of National Affairs, Inc., Washington 7, D. C.

Nursery chest has melamine laminate top, vacuum formed styrene slide-out trays, and drawer pulls of acrylic. (Photo, Monsanto)



Drawer with molded-in partitions is vacuum formed from wood-grain-finish impact styrene. (Photo, Vacuum Forming Corp.)

in furniture?



Durable molded phenolic drawer will not warp, is easily cleaned. (Photo, Bakelite Co.)

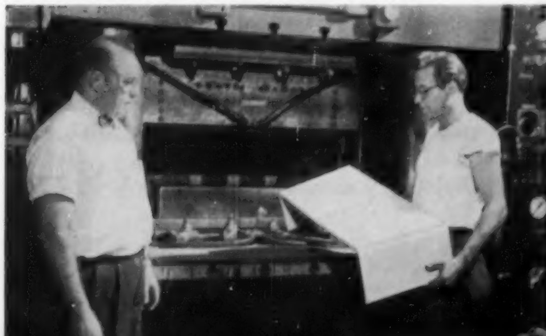
furniture, plastics offer numerous "built-in" properties that spell lower production costs—integral color, stain and scuff resistance, light weight, and the ability to be formed, molded, or fabricated into a vast variety of components or complete end products.

In addition, the uniformity of plastic materials and the ease with which they may be handled on a mass production basis make them ideally suited to automation.

Here are some of the recent developments which are opening up promising new horizons for plastics in the furniture industry:

Decorative Laminates and Resin-Bonded Products: A few years ago, a laminated plastic dinette table top was a rarity; today these tops dominate the industry so completely that it is difficult to find other types. With the development of authentic wood-grain patterns and,

Bedroom furniture offered by Sears, Roebuck has polystyrene drawers injection molded on 200-oz. machine (left). Drawer front is made of wood. (Photo, General Electric Co.)



Clubhouse chair with wide saran webbing and molded butyrate arms is comfortable, weather resistant

Contemporary chair has one-piece back molded of glass-reinforced plastics. (Photo, Knoll Assoc.)

Exterior housing of hassock fan, injection molded of styrene, blends harmoniously with other furniture. (Photo, Robbins & Meyers)

Molded glass-reinforced plastics shells are mounted on tubular legs to make chairs that can be conveniently stacked. The shell is sturdy, can be easily cleaned. (Photo, Monsanto)

more recently, the completely new color and design treatments, along with non-glaring satin finishes, the laminates have moved rapidly into other types of furniture—coffee tables, step tables, etc., and even into case goods such as desks, vanities, and chests (photo, p. 98).

Imaginative use of decorative laminates opens up many new design possibilities, as demonstrated in a somewhat unusual ensemble of case goods designed by Forest Wilson Associates for Ashley Furniture Corp., Chicago. Made on a modular principle, units in this group use all-steel frames and melamine sides, tops, and drawer fronts. Their related styling affords extreme flexibility of arrangement and enables the retailer to achieve maximum sales with a minimum inventory.

Resin-bonded wood chips and other forms of wood particles, converted by heat and pressure into dense, warp-resistant sheet stock, are finding many applications in the furniture industry. Typical of these products is 4-Square Particle Board, a product of Weyerhaeuser Sales Co., St. Paul, Minn. Ready to use without sanding, kiln-drying, or planing, the material is knot-free, has no grain to twist or warp. It makes an ideal core for decorative laminates and wood veneers, an excellent base for dinette table tops and sink tops, and also lends itself to construction of case and cabinet goods. Novoply, a three-ply laminate by U. S. Plywood Co., has faces of specially prepared wood flakes and a core of wood chips impregnated with urea resins; it is widely used as an attractive and durable table surface. Among other furniture applications, Novoply also serves as the core stock for the melamine laminate tops used by Daystrom Furniture for its extensive line of dinette tables.

Fiberesin Plastics, Oconomowoc, Wis., produces a resin-bonded type of panel in which a wood-particle core is combined with a melamine-impregnated top surface in various wood grains and other patterns. Produced in a single molding operation, this panel eliminates the customary laminating of a thin sheet to a core of plywood or other material.

Heywood-Wakefield, Gardner, Mass., recently introduced a line of classroom furniture molded from granulated wood combined with a Monsanto thermosetting resin (photo, p. 98). The Hey Woodite "child-proof" furniture, of which more than 10,000 units are now in service, has demonstrated its ability to withstand kicks, blows, scratches, ink, paste, paint, mud, and food spills without marring.

Relatively new to the growing plywood field

Vinyl upholstery (light-colored) on modern sofa not only adds decorative touch, but increases life of sofa arms. Cushioning is vinyl foam. (Photo, Bolta Div., General Tire & Rubber)

Bubbles in water tank demonstrate that vinyl pillow covering is air-porous. (Photo, B. F. Goodrich)

is a "fused" plywood, called CreZon, offered by Crown Zellerbach Corp. This material, which has a plastic surface, is said to permit splinter-free cutting and cleaner boring, drilling, and shaping operations than can be had with regular plywood. It is being widely promoted for built-ins and other cabinet work (photo, p. 98).

Plywood frame of chair is upholstered with "breathable" vinyl material. (Photo, U. S. Rubber Co.)

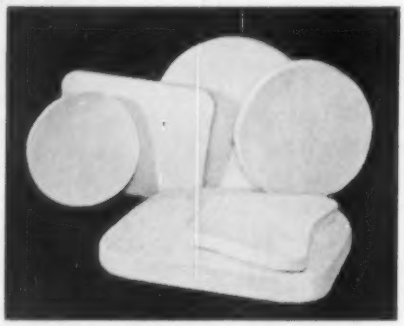
The Plastic Drawer: The plastic drawer epitomizes the functional and decorative potentialities of plastics in the furniture field. By-passing many of the time-consuming and costly fabricating and assembly operations long associated with wooden drawers, it clearly demonstrates one of the ways in which plastics can bring mass-production techniques and its concomitant economies to the furniture manufacturing field.

The plastic drawer is light, strong, and easily cleaned with a damp cloth. It resists staining, corrosion, warpage, and the action of most chemicals, drugs, etc. Its smooth surfaces eliminate snagging and tearing of clothes. Molded-in, permanent color does away with surface finishing.

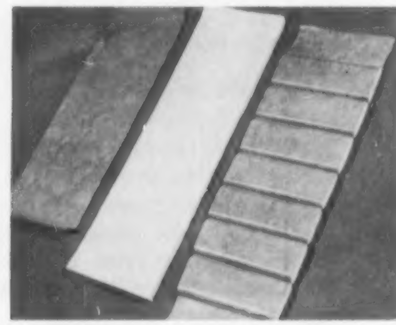
At least three basic approaches to the plastic drawer are now available. Drawers may be vacuum formed from thermoplastic sheet stock, compression molded of thermosetting materials, or injection molded of thermoplastics. All three production methods have their particular advantages, depending upon projected volume, type of furniture involved, and specific design and service requirements.

A number of interesting experimental furniture pieces (photo, p. 99) utilizing vacuum formed drawers have been made by Monsanto's Plastics Div., working in conjunction with the Industrial School of Design of Pratt Institute. Lustrex 88 high-impact styrene sheet stock was used. Vacuum Forming Corp., Port Washington, N. Y., has also produced various vacuum formed drawers. One type made by this company provides a single uninterrupted storage area; another is divided into four convenient sections by integral ribs (photo, p. 99). Both

Typical group of upholstered pieces uses polyurethane foam sheet stock as topper pad between fabric covering and other filling material. (Photo, Good Furniture)



Upholstery batts are produced by blending and fusing cotton linters with plastic binder



Vinyl foam sheet stock can be heat-sealed to vinyl-coated fabrics. (Photo, Elastomer Chemical)

drawers are formed of thermoplastic sheet stock having a wood-grain pattern. Sears, Roebuck & Co. is currently using a number of drawer liners vacuum formed from high-impact styrene sheet material, fabricated by Panelyte Div., St. Regis Paper Co.

Compression molded phenolic drawers, now being made by at least two molders, are used in some case goods produced by Warren Furniture Co.[2] Available in standard sizes, these drawers incorporate such features as molded-in runners and center guide flanges which simplify installation. They are attracting wide interest among architects, builders, and handymen who find them ideal for do-it-yourself projects. Since the drawers are molded in one piece, they have no joints to separate (photo, p. 99).

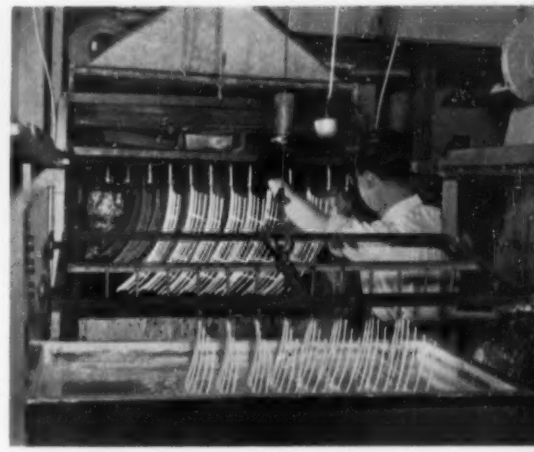
Most ambitious program to-date with injection molded drawers is by Sears. In one of its 1956 lines of bedroom suites are featured such drawers in both dresser and night-stand components. Made in two sizes—the largest measuring 34 by 15 by 8 in. deep—the drawers are molded of impact styrene in an aquamarine color which harmonizes with wood tones and general bedroom decor (photo, p. 99). Described as the first radical change in case goods drawer construction since the advent of the center guide and dovetailing feature, these drawers represent the coordinated efforts of the design and marketing departments of General Electric Co.'s Plastics Div., the G.E. engineering group at Decatur, Ill., where the styrene drawers are injection molded, and the Sears designers and testing and development department.

Design of the Sears three-sided drawer permits the furniture manufacturer to use any desired type of wood front for design flexibility, combining the advantages of plastics with the warmth and beauty of a natural wood exterior.

"Introduction of the plastic drawer," said Carl J. Bjorncrantz, director of the Sears industrial design department, "offers a fresh note of smartness and distinction, completely in keep-

[2]See "At Last—the Phenolic Drawer!" MODERN PLASTICS 31, 162 (March, 1953).

Dinette chairs are upholstered in textured vinyl sheeting, wire backs are plastisol-coated for chip-proof color and comfortable feel. Table top is melamine laminate



Chair backs in photo above are produced by dipping the wire skeleton into a plastisol-filled vat (right) and curing in oven. (Photo, E. H. Titchener & Co.)

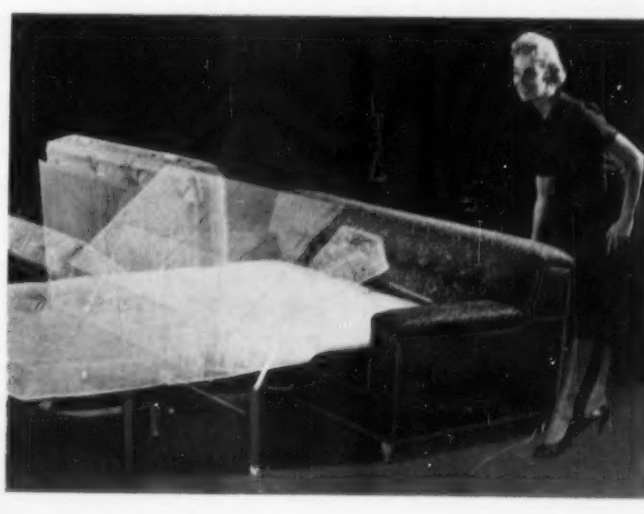
ing with today's well-designed furniture. Adapting plastics materials to new and attractive uses is an outstanding example of well-directed imagination, particularly where color, ease of cleaning, and high-style quality are evident."

Other Molded Applications: In addition to plastics drawers, there are many other examples of molded plastics which are becoming ever more firmly entrenched in the furniture field. Some of these products use conventional thermosetting or thermoplastic molding materials; others use polyester resins in combination with fibrous glass, sisal, or other types of reinforcing agents. The "payoff" in every case comes in the form of lighter weight, integral color, greater freedom of design, durability, and ease of cleaning—along with simplified assembly and elimination of costly finishing operations.

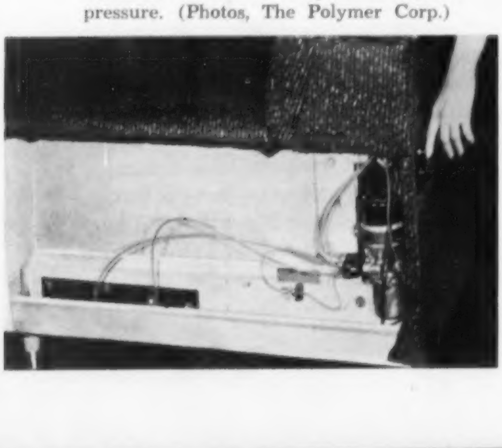
Many types of reinforced plastics chairs—some upholstered, others not—are now available. Colorful and comfortable, they fit in perfectly with modern trends in home decoration and casual living (photo, p. 100). By-passing many of the sawing, fitting, and gluing operations long associated with furniture manufacture, they give the designer free rein and lend themselves to economical mass production techniques. Reinforced plastics structural components for sofas, as introduced recently by Kroehler Mfg. Co.,[3] are an important new development which is well worth watching. Other manufacturers are also (*To page* 212)

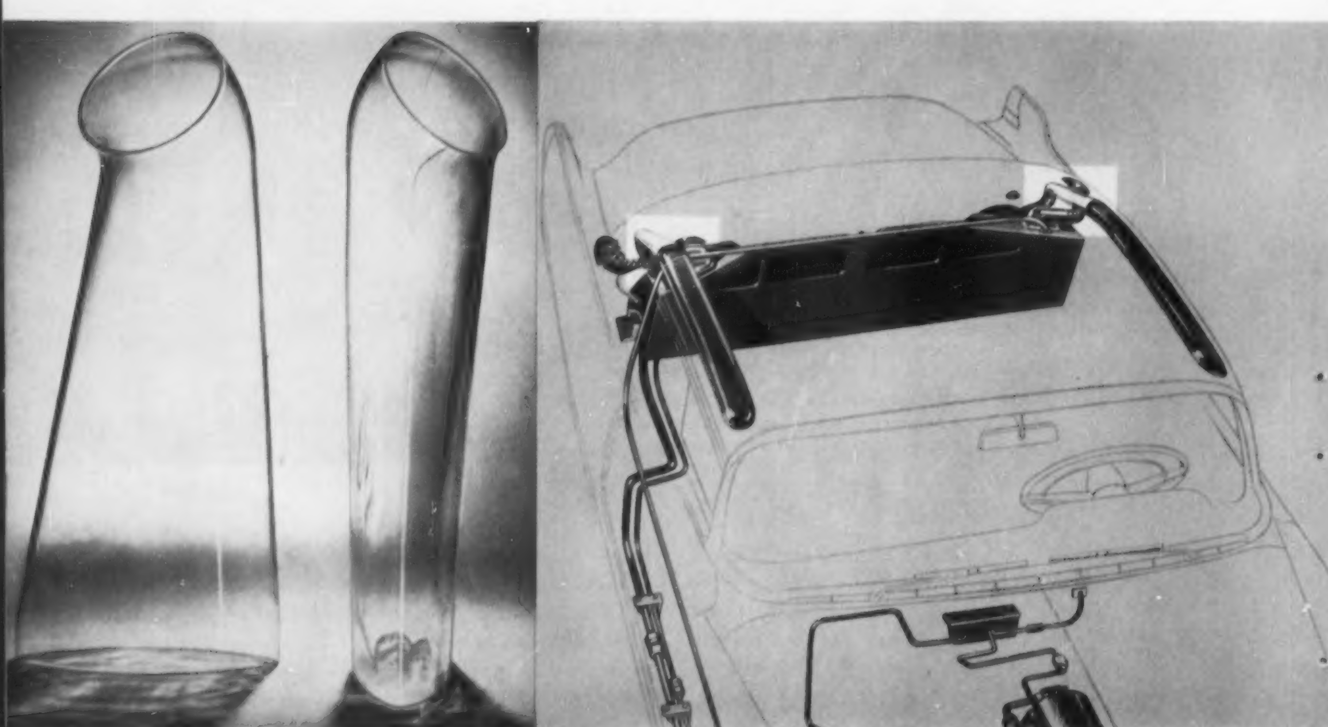
[3]See "Furniture With a Future," MODERN PLASTICS 33, 104 (Nov. 1955).

Sofa that changes to bed at push of a button uses 60 ft. of extruded nylon tubing as hydraulic lines



Part of hydraulic system of sofa at right. Nylon tubes withstand up to 1000 p.s.i. pressure. (Photos, The Polymer Corp.)





Transparent ducts (left) formed from acrylic tubing are an attractive part of automobile air conditioning system (right). The 17 in. long ducts designed to carry the cooled air into the car interior, are attached to the package shelf in the rear of the car

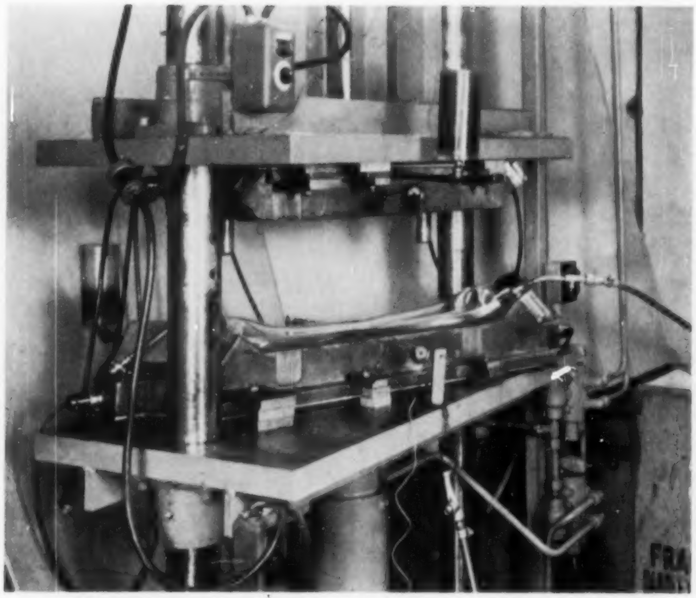
Blown acrylic for air ducts

Automobile air-conditioning system part, shaped from transparent tube, directs flow of cooled air inside car

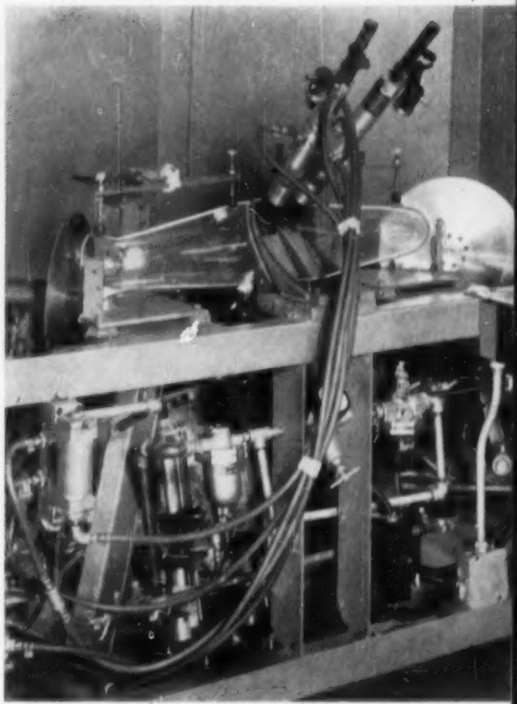
Reflecting the growing popularity of air-conditioned motoring, Cadillac Plastic and Chemical Co., Detroit, Mich., which manufactures blown acrylic diffusing ducts for automobile air-conditioning systems, reports that it has already delivered over 100,000 pairs of the ducts to the automobile industry.

The ducts are attached to the package shelf in back of the rear seat of the car and are designed to direct a flow of cool air uniformly throughout the car or to lead the cool air into metal conductor channels concealed in the roof lining. Since the ducts are the only visible part of the air-conditioning unit, the transparency and attractive appearance of acrylic, as well as its toughness and dimensional stability, dictated the choice of the material.

In the manufacture of the ducts, the acrylic tubing, with 2¾-in. O.D. and from 0.170 to 0.175 in. thick, is first preheated for 6 min. in a 370° F. oven. To insure even heat diffusion and forming, the tubes are lubricated (Solnus light medium oil by Sun Oil Co.) before being placed in the mold. Pressure forming is done in



Pressure-forming of a pair of ducts is accomplished in oil-heated, thermostatically controlled matched-metal molds at the rate of 10 to 12 pairs per hour



After molding, the 36 in. long acrylic tubing is cut in half and drilled on automatic equipment to make a pair of ducts. Operation takes only 45 seconds

thermostatically controlled oil-heated matched metal molds machined from polished aluminum castings. Air pressure is at 100 p.s.i. and the mold temperature is held at 220° F.

Two 17-in. (finished length) ducts, one a right-hand unit and the other a left-hand unit, are formed at the same time from a 36-in. piece of tubing. Wall thickness of the formed duct is from 0.080 to 0.120 inch.

After forming, an automatic cut-off regulated by electronic sequence timers activated by Microswitches is used to finish the two ducts in a single pass. Carbide-tipped saw blades are advanced by air-operated cylinders to make four independent saw cuts. When the cuts are complete, the saws are automatically withdrawn. Simultaneously, two holes are drilled into the ducts with Keller air-feed drills which similarly retract as soon as the holes have been cut. The entire cycle for this finishing operation takes only 45 seconds.

These automatic cut-off machines can easily be adjusted for a variety of cuts to meet the requirements of the various ducts.

Finished ducts are placed on inspection jig to check dimensions and shape. Optical clarity of ducts is inspected visually. (All photos, Cadillac Plastics)

Fig. 1: Wide-open filter plate mold being sprayed with release agent. Note finely grooved surface structure and inserts that form holes in thicker end sections

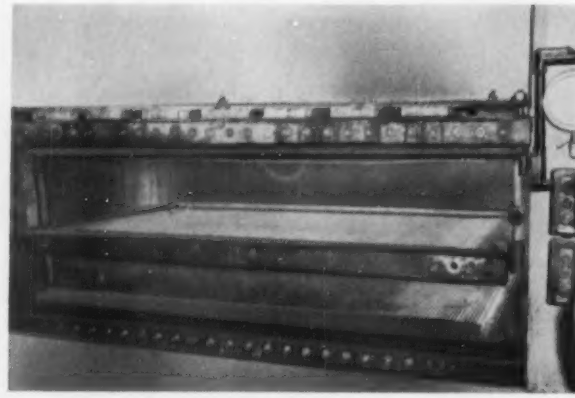


Fig. 2: Compression molded filter plate is lifted clear of bottom half of mold

World's LARGEST pressure moldings

Filter plates 24 sq. ft. in area are compression molded of asbestos-filled phenolic; pieces weighing up to 4 tons are autoclave-cured

One of the biggest compression moldings yet made is a 285-lb., intricately contoured filter plate for plate-and-frame filter presses used in the filtration of pigments. Stainless steels were considered for these plates but the job of machining the 144 alternate grooves and ridges needed in each face of the plate would have been extremely costly. Aside from this, pilot experiments showed that stainless plates could be expected to last only about one month under exposure to highly corrosive filtrates. The Haveg Corp. was asked to make these plates of one of its asbestos-filled phenolic compositions that has demonstrated outstanding chemical resistance. An intricate pattern of corrugations was required on both faces of each plate. Because of this intricacy and the great weight of the plate, it was feared that the moldings might be damaged in ejecting them from the mold. None of the company's then-available presses could do the job. After consulting with Hydraulic Press Mfg. Co., Haveg engineers decided it could be done in a 200-ton press with the lower platen recessed to hold a frame that would gently ease the finished plate from the mold.

Properties of compounds

Within a few months Haveg was molding plates of its compound 41 on a 100-min. cycle.

Haveg molding compounds were developed

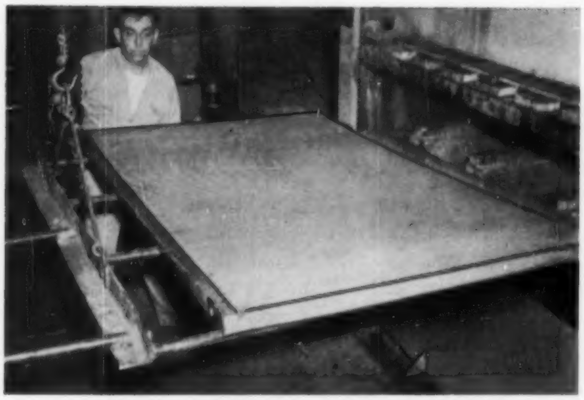


Fig. 3: Operator guides cured molding out of press. A second operator (out of sight at left) acts as counterweight on the rack

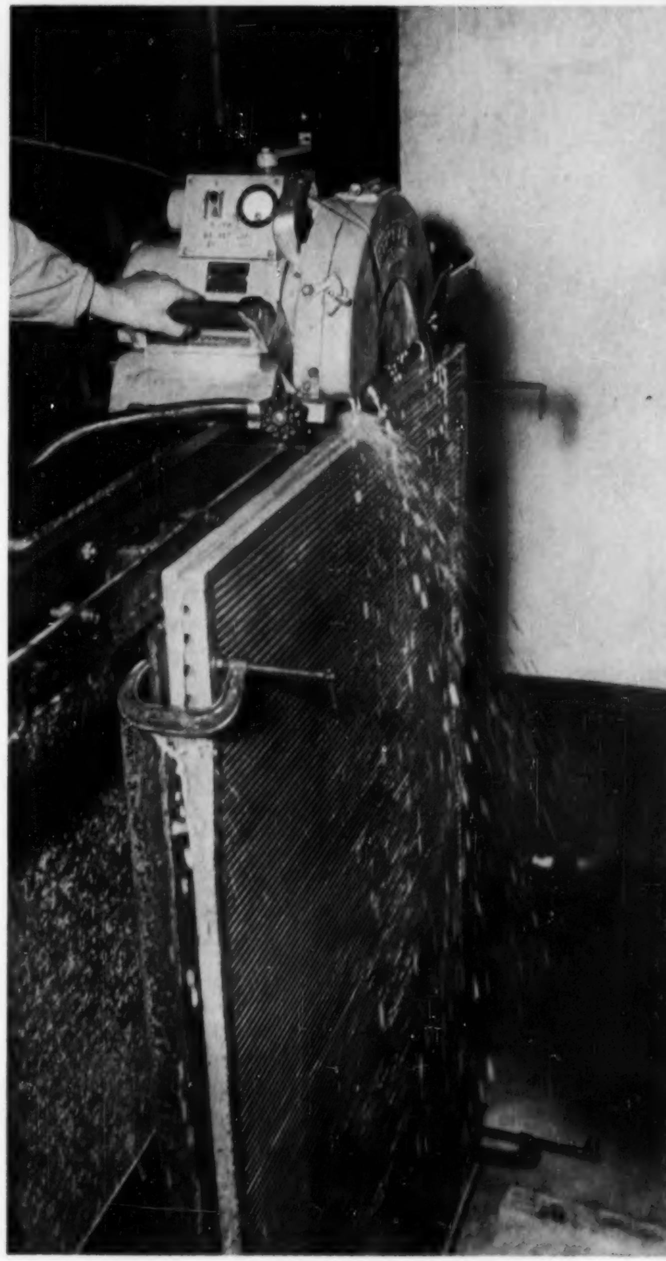


Fig. 4: Groove is sawed into end face of molded plate. Molding compounds are so hard that, if cooling water were not used, saw would dull rapidly. (Photos, Haveg Corp.)

particularly for chemical service. The asbestos filler fibers in compound 41 are pre-extracted with hydrochloric acid before compounding, a treatment that removes all acid-soluble components of the asbestos and makes it invulnerable to further attack by strong acids. The asbestos fiber, which is to some degree degraded by the extraction process, adds little to the strength of the base resin. Thus compounds made of such asbestos and phenolic have, relative to most other plastics, low tensile strength, elongation, and impact strength at room temperature. On the other hand, their properties are better at high temperatures. Haveg 41 phenolic, for example, has tensile strengths of 3800 p.s.i. at 80° F. and 2100 p.s.i. at 300° F. It has been used at temperatures as high as 390° F. in continuous service.

Compression molding the big plates

Figure 1, p. 106, shows the fully opened mold being sprayed with mold release just before the charge is loaded. The plates are thickest at both ends and taper gradually to the thinnest sections at the center. The grooves in the plates provide channels through which filtrate and wash liquor are sucked when the filter press is operating.

The doughy charge of molding compound is loaded by hand and is distributed in the mold in a pattern calculated to give even flow to all parts of the mold as the press closes. Cure is

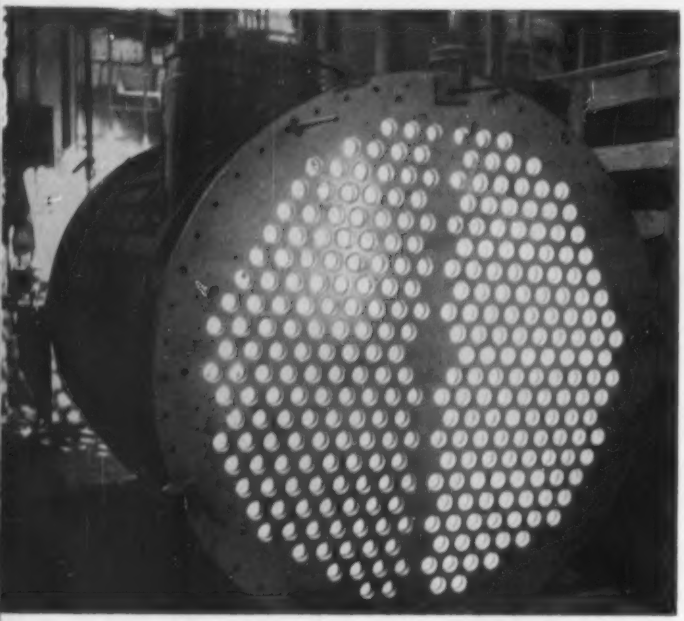


Fig. 5: Fabricated multi-tube heat exchanger. Tubes are cemented into end plates

This asbestos-filled phenolic is a hard, fairly strong material that can be machined relatively easily. In Fig. 4, p. 107, an operator is sawing a groove into the end surface of the molded plate. Later on, a number of 1-in. holes are drilled and tapped.

continued at about 360° F. for over an hour. Then the mold is opened part-way, bringing the special frame snugly up against the molded filter plate. This frame gently breaks the piece free from the bottom half of the mold as the operator raises the upper platen to the fully opened position. (See Fig. 2, p. 106.) It is then lifted out of the mold with a fork-like device suspended from a hoist and stacked for subsequent finishing operations. (See Fig. 3, p. 107.)

The total molding cycle for the plate, including the time required for mixing the resin and fillers as well as the mold filling and part removal operation, is about one man-day/plate.

Extra-large moldings

Large sections of pipe, pipe fittings, intricate valves, and all sorts of chemical processing equipment are also made from these asbestos-phenolic compounds. Although most chemical engineers know them as corrosion-resistant piping materials, few know that some tremendous pieces of equipment have been fabricated of asbestos-filled thermosets. Aside from the large matched-metal molding described above, and others like it, many articles have been made from these materials by forming the uncured compound into the desired shape and then placing the preform and mold into a large autoclave where it is cured by hot air under high pressure. By this process single pieces have been made that weigh up to 4 tons! Figure 5, above, shows a heat exchanger during manufacture. End plates, shells, and fittings for this exchanger were made of asbestos-filled phenolic moldings. Because high thermal conductivity is required in the heat-exchanger tubes, they were made of glass or impervious graphite. The cylindrical surface of this shell is reinforced with steel rings against the internal pressure.

In Fig. 6, below, are three large tanks ready for delivery on a flat car, and in Fig. 7 are shown three towers made of asbestos-filled phenolic. One of the most attractive features of this material is its low cost when fabricated to the customer's specifications—from 70¢ to $1.20 per pound, ready to ship. The towers in

Fig. 6: Three large asbestos-filled phenolic tanks ready for shipment. Note wood and steel-strap reinforcement of cylindrical shells. (Photos, Haveg Corp.)

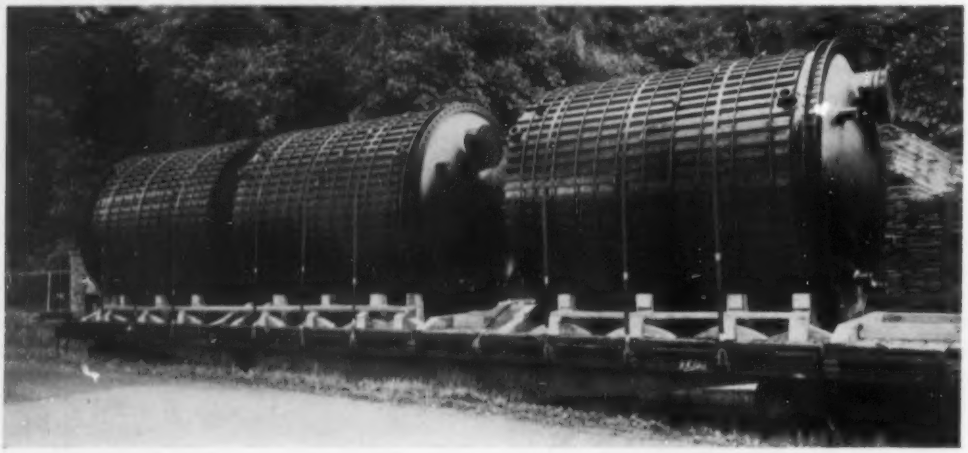


Fig. 7: Many asbestos-filled phenolic moldings in petroleum chemical plant, a part of which is shown at right, go into acid scrubbing towers *T*, heat exchangers *H*, etc.

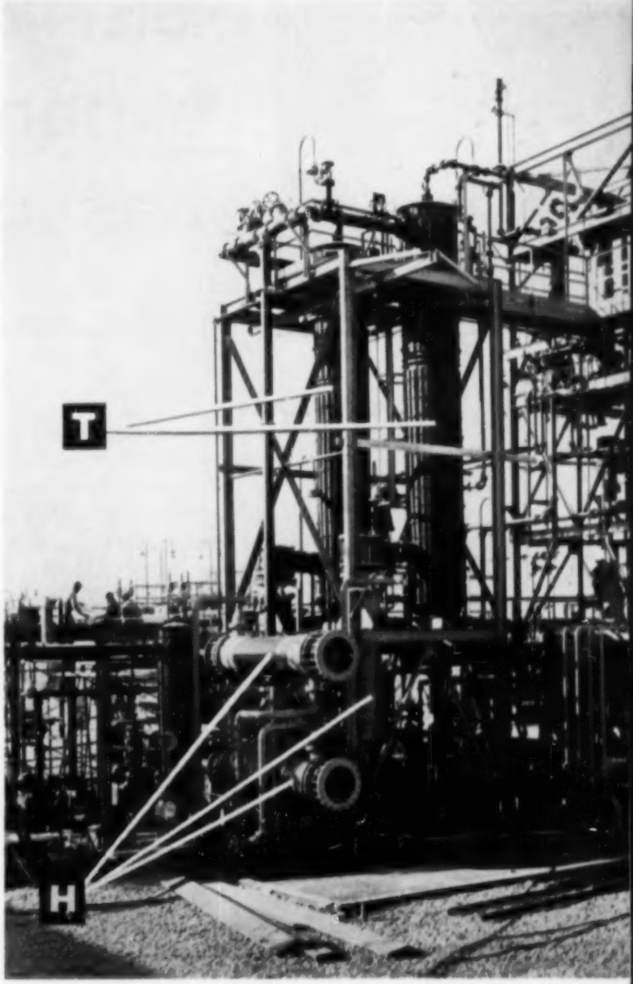


Fig. 7 were molded in large sections and assembled at the customer's plant. Such sections are molded by a spinning technique on the inside surfaces of assembled steel forms. When the molding compound has been shaped, it is cured in an autoclave. After curing, the steel shell is disassembled from the finished molding. More intricate shapes, e.g., valve bodies, are laid up by hand on male or female forms made of wood or metal. These techniques are made possible by keeping a careful balance between plasticity and strength in the uncured material: it can be shaped easily but does not flow appreciably under the force of its own weight.

Fume stack is biggest yet

The tallest structure so far made of molded sections of these materials is the stack for chemical vapors and smoke shown (while under construction) in Fig. 8. Here again stainless steel could not be used because it corroded too rapidly. The finished stack is about 200 ft. tall and was erected on the site from 15 molded sections totalling 42,000 lb. in weight. The steel superstructure keeps the tower from bending under wind-imposed bending loads. A preliminary survey is now being made for a unit several times the size of this stack!

These asbestos molding compounds, because of their ease of fabrication, chemical resistance, low cost, and their ability to be made into very large items, have become important engineering materials for the chemical industry.

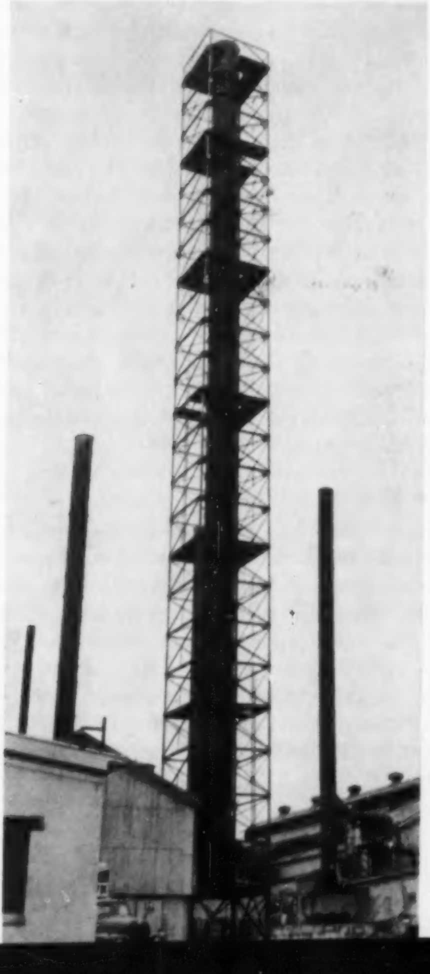


Fig. 8: Largest structure yet made of asbestos-filled phenolic, this 200-ft. chimney weighs 21 tons. (Photos, Haveg Corp.)

BENELUX: expansion based on research

*By P. Schwencke**

The Netherlands

Most of the plastics produced before the war in The Netherlands were used in paints and lacquers of which the country has the highest per-capita consumption in the world. At that time mainly phenolic, urea, and alkyd resins were manufactured, together with phenolic molding powders, cellulose nitrate, and large quantities of casein-formaldehyde.

Presented here is the seventh article in the series "Wide World of Plastics" which started in our May issue.

These authoritative articles are written by plastics publication editors or industry leaders. The purpose of the series is to show the progress of plastics throughout the world.

In each succeeding issue, countries not checked in the list at the right will be represented.

Argentina
Australia
Belgium
Brazil
Canada
Denmark
France
Germany (West)
Great Britain
Holland
India
Israel
Italy
Japan
Luxemburg
Mexico
New Zealand
Norway
South Africa
Spain
Sweden
Turkey

Covered in this issue

In previous issues

Of course, the loss of the Dutch East Indies after World War II caused an alteration of the Dutch economy, but it seems to have been an impulse for an enormous industrial expansion at home. At this moment, half the national production is exported; the chemical industry accounts for 7½% of the national output. During the past five years the importance of the plastics industry has rapidly increased, mainly as a result of the activity of the big chemical concerns.

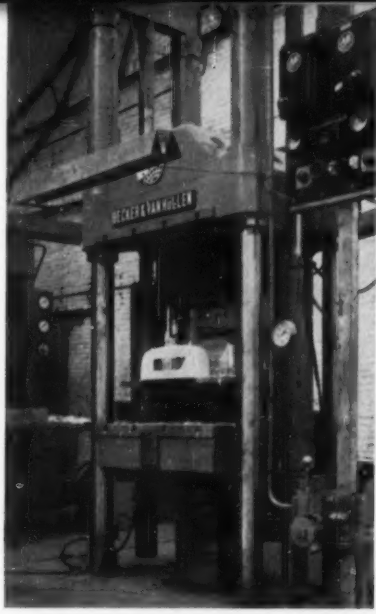
The State-owned coal mines—Staatsmijnen—encompass also the largest chemical factories in the country. This chemical industry does not manufacture plastics as such, but it does supply the plastics industry with many important raw materials. One of the bulk chemicals of Staatsmijnen is urea, for which an annual capacity of 50,000 tons is available. The main outlet is in fertilizers but it is also used in resins. The production of urea-formaldehyde molding powders in Holland was discontinued a year ago. However, phthalic anhydride is produced, which is supplied as a raw material for alkyd resins and plasticizers.

Some years ago the production of synthetic phenol was started. The full production is at present converted into caprolactam, basic material for nylon-6.

Petrochemical facilities

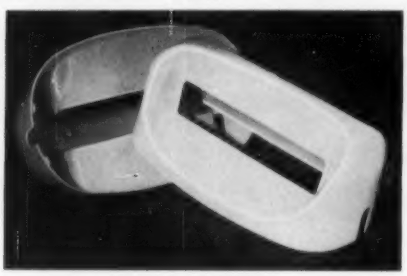
Staatsmijnen has recently obtained an exclusive Ziegler-process license in the Benelux countries and will build a plant near its Beek factory, scheduled to go on stream late in 1957. Exploration for crude oil first started about ten years ago and the production is still rather small. In spite of that, the refinery of N. V. Bataafsche Petroleum Maatschappij (B.P.M.), the Dutch production and exploration company

*Plastics Research Institute T.N.O., Delft, Holland.



Fibrous glass - reinforced plastics wringer for housing, molded in hydraulic press at Huijgens Works in Holland

Close-up of molded one-piece glass polyester wringer housing, showing details of efficient design



of Royal Dutch Shell, is the largest in the whole of Europe, depending largely on the import of crude oil. Since the war period, B.P.M. has established petrochemical facilities near its Pernis refinery, where the production of PVC and epoxy resins was started some years ago. The raw material for the latter, epichlorohydrin, is still imported from Shell Chemical Co., U.S.A., which indirectly is a B.P.M. subsidiary; the Koninklijke Zwavelsuurfabrieken v/h Ketjen N.V. in Amsterdam supplies the bisphenol required.

B.P.M. also has a new epichlorohydrin plant under construction in Pernis, which will go on stream in midsummer, 1957. Shell affiliates abroad such as Petrochemicals Ltd. and Rheinische Olefinwerke manufacture many plastics, including polyethylene.

The Dutch A.K.U. concern plays an important part in the international rayon and synthetic fiber market; 12% of the world's pro-

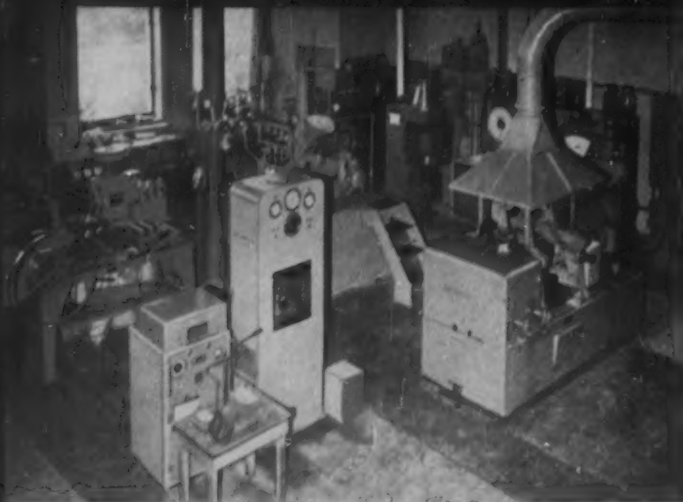
Netherlands

Manufacturers of raw materials

Phenol
Staatsmijnen, Geleen
Urea
Staatsmijnen, Geleen
Phthalic anhydride
Staatsmijnen, Geleen
Caprolactam
Staatsmijnen, Geleen
Vinyl acetate
N.V. Electro- Zuur- en Waterstoffabriek, Amsterdam
Bisphenol
N.V. Koninklijke Zwavelzuurfabriek v/h Ketjen, Amsterdam
Casein
N.V. Lijempf, Leeuwarden
N.V. De Meijerei, Veghel

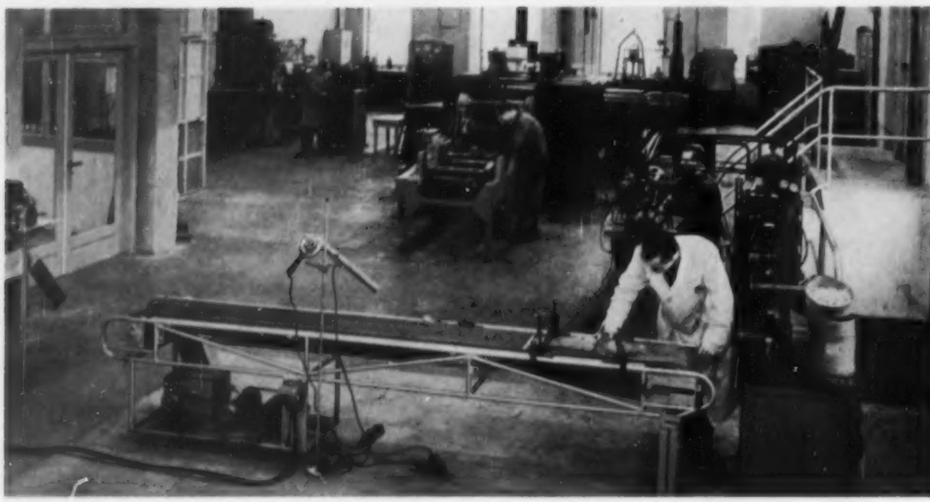
Manufacturers of plastics materials

Phenolic molding powders
N.V. Avis, Westzaan
N.V. Corodex, Zandvoort
N.V. Philips Gloeilampenfabrieken, Eindhoven
Polyester resins
N.V. Philips Gloeilampenfabrieken, Eindhoven
N.V. Adriaan Honigs Kunstharsindustrie, Zaandam (For some products licensee of Hercules Powder Co., U.S.A.)
Kunstharsfabriek Synthese N.V., Sassenheim (Licensee of Reichhold Chemicals, U.S.A.)
Chem. Industrie Paul Schoemaker, Deventer
Polyvinyl chloride
N.V. Bataafse Petroleum Maatschappij, Pernis (Subsidiary of Royal Dutch Shell)
Polyamides
Algemene Kunstzijde Unie N.V., Arnhem
Coumarone-indene resins
N.V. Teerunie, Uithoorn
Casein-formaldehyde
Hollandse Casolithwerken, Leeuwarden
Internationale Kunsthoorn Industrie, Voorschoten
Phenolic, urea, alkyd resins
N.V. Chemische Industrie Synres, Hook of Holland
Kunstharsfabriek Synthese N.V., Sassenheim
N.V. Kunstharsindustrie Scado, Zwolle
N.V. Adriaan Honigs Kunstharsindustrie, Zaandam (For some products licensee of Hercules Powder Co.)
Epoxy resins
N.V. Bataafse Petroleum Maatschappij, Pernis (Subsidiary of Royal Dutch Shell)
Polyvinyl acetate
N.V. Nationale Zetmeelindustrie, Veendam
N.V. Lijm- en Gelatinefabriek, Delft
W.A. Scholtens Chemische Fabrieken N.V., Foxhol
Kunstharsfabriek Synthese N.V., Sassenheim (Licensee of Vinyl Products Ltd., England)
Plasticizers
Kon. Nederlandse Gist- en Spiritusfabriek N.V., Delft
N.V. Koninklijke Zwavelzuurfabriek v/h Ketjen, Amsterdam
N.V. Kunstharsindustrie Scado, Zwolle
Colorants and pigments
Ferro Enamels (Holland) N.V., Rotterdam (Subsidiary of Ferro Corp., U.S.A.)
N.V. Chemische Fabriek v/h Dr. A. Haagen, Roermond
N.V. Chemische Verfstoffenfabriek v/h L. Th. ten Horn, Maastricht
Verfstoffenfabriek Holland N.V., Apeldoorn



One section of the Dutch Plastics Research Institute, T.N.O., where technological research on plastics is carried out

Another section of the Institute. Pilot-plant operations at this center help advance the plastics arts in the Benelux countries



duction of rayon is accounted for by A.K.U. or A.K.U. affiliates, such as American Enka Corp. (55.3% A.K.U.) and the German Vereinigte Glanzstoff Fabriken A.G. (75.8% A.K.U.). A.K.U. manufactures polyamide fibers (Enkalon) and plastics (Akulon) in Holland. The required caprolactam, supplied by Staatsmijnen, is polymerized by A.K.U. Polyester fiber is being made on a pilot-plant scale under I.C.I. license.

In the prewar years, the production of calcium carbide was started by N.V. Electro Zuuren Waterstoffabriek, Amsterdam, which is still the only manufacturer in the country. Vinyl acetate is made from the acetylene thus made available and the monomer is supplied to paint and adhesive manufacturers which polymerize the material.

Philips is the largest processor of plastics in Holland. This international electrochemical concern is at the same time the largest manufacturer of phenolic molding powders. Some years ago Philips needed such large quantities of polyester resins for electrical embedments that it started production in its own plant. During the past few years, glass-reinforced plastics have also become an outlet for these resins. Although the consumption of polyester resins is still rather small, there are four manufacturers of the resin in Holland. The fabricating of reinforced plastics has not yet been developed strongly, but there is a considerable market interest in this material. Holland has a considerable export surplus of coumarone resins, which are produced by only one manufacturer, Teerunie N.V., Uithoorn.

In 1955 a subsidiary of The Dow Chemical Co. was established in Rotterdam. In due course, production will start on polystyrene and many other plastics, as well as products outside the plastic field.

As a result of the favorable economic climate and the progressive policy of the Dutch government to stimulate industrial expansion, many

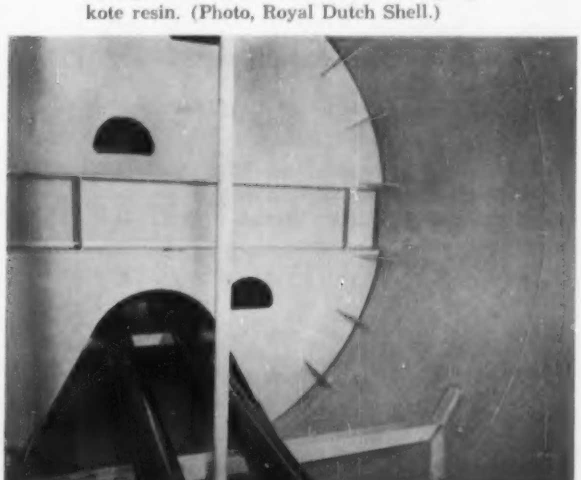
American firms have erected plants in Holland. An example is Merck & Co., Inc. H.P.M. and Watson-Stillman injection molding machines are manufactured under license in this country and then exported for use in other European countries.

Belgium

The name of the Belgian chemist, L. H. Baekeland, to whom a patent was granted on the processing of phenol-formaldehyde under heat and pressure in 1907, is well known in plastics history; another world-famous Belgian chemist, Ernest Solvay, developed what is still the most economical process for manufacturing soda. Although the invention of Solvay had nothing to do directly with plastics, he was the founder of Solvay & Cie, which is today by far the most influential chemical concern in Belgium.

Solvay & Cie was established in 1863. In contracting a license-agreement with the English firm, Brunner Mond & Co. Ltd., Solvay acquired considerable financial interest in this firm. A few years later the English soda concern had built up such a strong financial position that it could obtain a great interest in the later-formed I.C.I. concern. There is not only a financial relation between Solvay and I.C.I. but also close cooperation, which was demonstrated in the joint establishment of Solvic S.A. pour l'Industrie des Matières Plastiques in 1949. Solvic manufactures various types of emulsion and suspension PVC as well as PVC compounds and vinyl copolymers. Solvic also

Inside walls of tank car for transport of detergent are coated with cold-setting Epikote resin. (Photo, Royal Dutch Shell.)



Belgium

Manufacturers of raw materials

Phenol
- Cartonisation Centrale S.A., Brussels
- S.A. John Cockerill, Seraing-sur-Meuse
- Association Métallurgique pour la Fabrications du Coke S.A., Brussels
- Distillerie de Foudron Robert & Co., Rausart
- Société-Chimique de Selzaete S.A., Brussels
- Union Chemique Belge S.A., Schoonaarde (Subsidiary of Solvay & Cie)

Formaldehyde
- Société Belge de l'Azote et des Produits Chemiques du Marly, Liège

Phthalic acid and anhydride
- Union Chemiques Belges S.A., Schoonaarde

Maleic acid and anhydride
- Union Chemiques Belges S.A., Schoonaarde

Manufacturers of plastics materials

Phenolic molding powders
- Société Belge de l'Azote et des Produits Chemiques du Marly, Liège
- Usines Belges Vynckier Frères S.A., Gent

Polyester resins
- Union Chemique Belge S.A., Drogenbros (Subsidiary of Solvay & Cie)

Polyvinyl chloride and vinyl copolymers
- Solvic S.A. pour l'Industrie des Matières Plastiques, Brussels (Subsidiary of Solvay & Cie and I.C.I. Ltd.)

Cellulose acetate, cellulose acetate butyrate
- S.A. Fabelta, Brussels (Subsidiary of U.C.B.)

Ethyl cellulose and cellulose nitrate
- Poudrerie Royale de Wetteren Cooppal & Co. S.A., Brussels

Silicones
- Union Chemique Belge S.A., Saint-Ghislain (Licensee of Dow Corning)

Polyvinyl acetate
- S.A. Fabelta, Brussels (Subsidiary of U.C.B.)

Phenolic and urea resins
- Société Belge de l'Azote et des Produits Chemiques du Marly, Liège
- Les Usinè de Callenelle S.A., Cassenelle
- Vernis Claessens S.A., Deurne-Antwerp
- Poudrerie Royale de Wetteren Cooppal & Co. S.A., Brussels
- S.A. des Produits Gallic, Bost-lez-Tirlemont
- Ed. Masereel, Forest-Brussels
- Union Chemique Belge S.A., Drogenbros (Subsidiary of Solvay & Cie)

Acrylic resins
- Union Chemique Belge S.A., Drogenbros (Subsidiary of Solvay & Cie)

Coumarone-indene resins
- Carbonisation Centrale S.A., Brussels
- Carburants & Goudrons de Forest S.A. (Carfor), Forest-Brussels
- Association Métallurgique pour la Fabrication du Coke S.A. Willebroeck
- Distillerie de Goudron Robert & Co., Rangart
- Société Chemique de Selzeate S.A., Brussels
- Union Chemique Belge S.A., Havre-Ville (Subsidiary of Solvay & Cie)

Plasticizers
- Union Chemique Belge S.A., Drogenbros (Subsidiary of Solvay & Cie)
- Société Belge de l'Azote et des Produits Chemiques du Marly, Liège

Benelux plastics imports and exports, 1955

Materials	*Holland*		*Belgium—Luxemburg*	
	Imports	*Exports*	*Imports*[c]	*Exports*[c]
	1000 lb.	*1000 lb.*	*1000 lb.*	*1000 lb.*
Acrylics	1,098	24	1,070	73
Cellulosics	1,528	2,809	1,289	537
Fluorocarbons	0.5[a]	—	—	—
Nylons	1,157	723	53	0.5
Polyethylenes	2,791	37	—	—
Styrene polymers	2,352	254	2,732	50
Vinyls	14,304	[b]	6,041	[b]
Aminos (melamine & urea)	8,618	2,022	7,254	91
Phenolics (molding, laminating, and industrial resins)	3,613	5,320	1,766	1,954
Polyesters	—	—	—	—
Epoxies	—	—	—	—

[a] estimated
[b] restricted
[c] Jan.-Nov. 1955

has subsidiary companies in France, Italy, Austria, Spain, and Brazil. The total production capacity is continuously increasing and will reach a level of 55,000 tons/year in 1957.

The largest affiliate company of solvay in Belgium is Union Chimique Belge S.A. (U.C.B.). To its line of products of interest to the plastics industry belong phthalic and maleic acid and anhydride, alkyd, polyester, acrylic, coumarone, and modified maleic resins. U.C.B. raised the capacity of its tricresyl phosphate facilities recently by 60 percent. License for the production of silicones was obtained from Owens-Corning Fiberglas Corp. last year.

The Belgian production of acetate and viscose rayon amounted to 30,480 tons in 1954, whereas in this year 1361 tons of fully synthetic fibers were produced.

The main manufacturer in the fiber field is the U.C.B. affiliate Fabelta which produces rayon and acrylonitrile fibers, and lately polyamide fibers in its pilot plant in Zwijnaarde.

The principal Belgian producer of semimanufactured products, Société Industrielle de la Cellulose (Sidac), also belongs to U.C.B.

It is clear from this brief survey that Solvay & Cie has a strong position in the Belgian market, but the influence extends also to other countries; Solvay has a controlling interest in the American concerns Allied Chemical & Dye Corp. and Libbey-Owens-Ford Glass Co.

Another important Belgian firm is Société Belge de l'Azote et des Produits Chimiques du Marly, which has a considerable output of phenolic resins and molding powders and amino resin-based adhesives. This firm developed its own process for the manufacture of vinyl chloride. It is not used in Belgium, however, owing to the strong position of Solvic, but is being used in Spain.

Coal is the basic material for the Belgian chemical industry, but the Belgian coal mines are beginning to become a bit out of date and consequently they produce at a high cost. This makes competitive production difficult, particularly for bulk chemicals, where a small difference in price is often conclusive. Much attention has therefore been given to such new raw material resources as petrochemicals. This has resulted in the establishment of Société Chimique des Dérivés du Pétrole (Petrochim), involving eleven participating companies, including, for example, the chemical concerns U.C.B. and l'Azote. A plant under construction, in the neighborhood of Antwerp, will go on stream at the end of this year. Among the many chemicals that will be produced will be terephthalic acid and acrylonitrile.

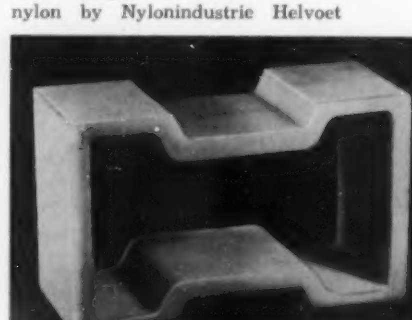
Luxemburg

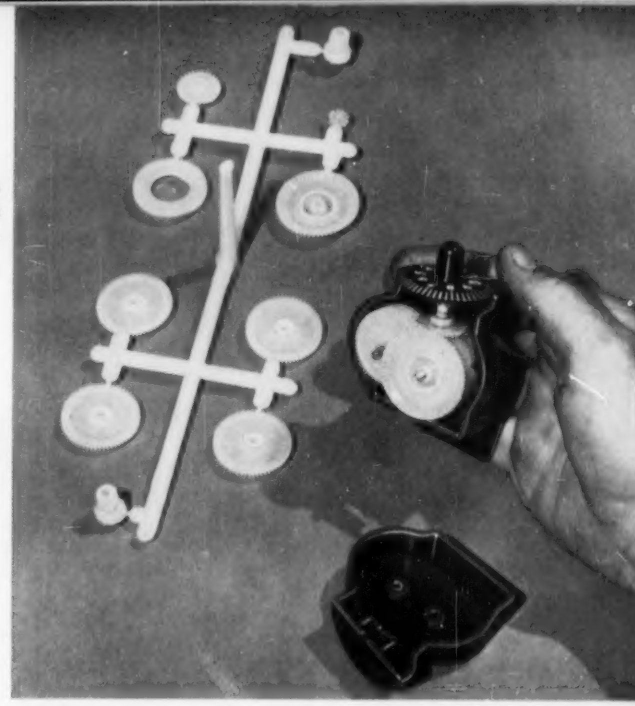
The smallest partner of Benelux, Luxemburg, is important for its coal and iron mines. The chemical and plastics industries, however, have been neglected. In economics, this small country is closely connected with Belgium and has even the same monetary unit.

Import duties of Benelux

The Benelux countries do not levy import duties from each other. Thus the market for the industries in these countries as a group is enlarged, leading to increased productivity and a stronger economic position (*To page* 222)

Form for making concrete "stone," 11 in. long, is molded of Akulon nylon by Nylonindustrie Helvoet





Eight nylon gears and two nylon assembly nuts for use in line-measuring device are produced in a 10-cavity mold. At extreme right is shown gear assembly in one half of styrene housing

Lightweight device is quickly clamped to fishing rod, measures amount of line as loop passes around molded capstan. (Photos, Du Pont)

How much line is out?

Fishermen get a better product through use of nylon gears and styrene housing in line-measuring device for trolling

A handy fisherman's aid for sounding and for determining bait depth—desirable information when trolling—is available in the form of a lightweight (only 3½ oz.) plastic device known as the Trollmeter. With the exception of bronze bearings and stainless steel shafts, all the parts for the unit are molded of rustproof, corrosion-resistant plastics—either nylon or styrene. These components include a train of eight molded nylon gears, two molded nylon nuts used for clamping the device to the fishing rod, a styrene case with a molded styrene dial attached to it, a two-piece capstan, and a styrene clamping bracket.

When the device is in operation, the fishing line is simply looped once around the capstan projecting out from the styrene case. As the line is paid out, it causes the capstan to turn. The capstan turns the train of nylon gears and the motion is transmitted to the dial on the case. This dial indicates the pay-out in 2-ft. increments up to 100 ft. and then repeats. It can be reset at any time by lifting the dial and rotating it back to zero.

Originally, the gear train used in the device was made of brass. By switching to nylon, however, the manufacturer found that the weight of the unit could be drastically reduced, that the problem of corrosion when exposed to salt water could be completely eliminated, and that lubrication problems could be greatly simplified. Cost-wise, the manufacturer reports that the "entire set of eight nylon gears costs less than one brass compound gear would on a quote of 10,000-unit lots."

In the construction of the case components and the clamping bracket, styrene was chosen because of its moldability, its *(To page 224)*

3-D styrene maps

Vacuum formed three-dimensional maps, which have proved their value in a number of military uses, are now being offered to the consumer field in the shape of decorative wall relief maps formed to the curvature of the earth. Designed for use in homes, offices, and schools (the maps have been tested and approved by the Association for Childhood Education International), such features as valleys, mountains, etc., stand out in true-to-scale relief.

The maps, formed of tough, washable, 20-gage styrene sheet, measure 23 in. in diameter and 6 in. in depth; they weigh only 14 oz. and have a flat sheet of cardboard mounted on the back to facilitate hanging. After the maps are formed, ochre, sepia, and turquoise tones are sprayed on in separate passes using special masks. Seven different maps are available, each showing a different section of the earth.

Credits: Manufactured by Panoramic Studios, Phila., Pa.; sheet by Auburn Button Works, Phila., Pa.

PLASTICS

Unbreakable glasses

All-plastics sunglasses with one-piece injection molded frames of unbreakable polyethylene and acetate lenses provide the maximum in strength, flexibility, durability, and safety. Designed specifically to withstand the abuse of children, the sunglasses are as safe for toddlers as they are for romping youngsters; the glasses will bend, bounce, twist, and can be stepped on without breaking—and they will even resist torturing tug-of-war treatment. The metal hinges and rivets which are accepted parts of conventional sunglasses have been replaced by integral molded polyethylene hinges.

The stamped acetate sheet used for the lens material provides excellent protection for young eyes from the glare of sunshine.

The sunglasses are available in plain models or with "wild west" motif, and are inexpensively priced.

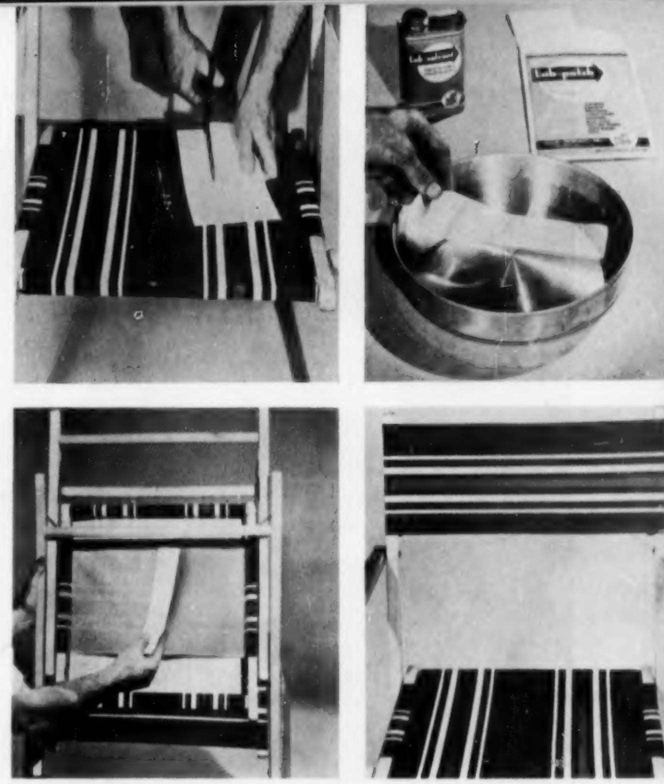
Credit: Smoothee sunglasses molded and manufactured by Foster Grant Co. Inc., Leominster, Mass.

Vinyl patch kit

A new solvent-activated patching material, consisting of fabric impregnated with vinyl resin, provides an inexpensive way to make quick and durable home repairs on canvas, leather, wood, and metal. As shown in the photos (right), the material, which is supplied in 5- by 8-in. swatches, is cut to size and then dipped in solvent for three to five seconds. The activated patch is then applied over holes, tears, seams, etc., and smoothed tightly over the surface; in about an hour it will harden into any shape or contour.

The vinyl resin used in the patching material is resistant to water, rain, and rust, and is, therefore, especially practical for outdoor furniture. The patch may also be used to repair broken toys; to reinforce seams in worn luggage; to patch awnings, sails, tents, golf bags; to cover rusted-out holes in metal cans, etc.

Credits: Lab-Patch and Lab-Solvent produced by Alvin Products, Inc., Worcester, Mass.; Vinyl supplied by Bakelite Co.



PRODUCTS

Acrylic lantern

With black-painted wrought iron replaced by textured black acrylic, a new outdoor post lantern compares favorably with traditional models by offering such advantages as light weight, weather resistance, low cost, and elimination of painting problems; at the same time it retains the familiar appearance associated with iron lamps.

The lamp, which measures 18 in. high and nearly a foot square, is composed of 11 acrylic parts. The largest of these, the hood, is molded in one piece to provide rainproof ventilation. The other acrylic parts, which include four corner posts, a base plate (with molded-in holes for drainage), and four lamp-base sides, are bolted together at the top and bottom of each corner post to hold four glass panes firmly in place. The lamp is topped with a brass finial.

Credits: Cape Cod lamp manufactured by Engineered Products, Inc., Kirkwood, Mo.; distributed by Western Circle Co., St. Louis, Mo.; acrylic supplied by Rohm & Haas Co., Philadelphia, Pa.

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Dr. James F. Carley, Engineering Editor

Automatic sheet forming

Inner doors for refrigerators are formed on automatic machines which save floor space and labor and have improved the product

By Donald A. Davis†

Automatic vacuum forming has grown into a multimillion dollar business at G.E.'s Appliance Park. Originally consisting of a single manually operated machine, the department now comprises 10 automatic vacuum forming machines, 2 hand machines and 8 sheet extrusion lines.

The versatility offered by plastics in the design of appliances resulted in a decision in 1953 to set up a pilot extrusion and vacuum forming operation. A comparison of vacuum forming with injection molding for making large refrigerator parts showed a considerable savings in investment and tool costs for vacuum forming.

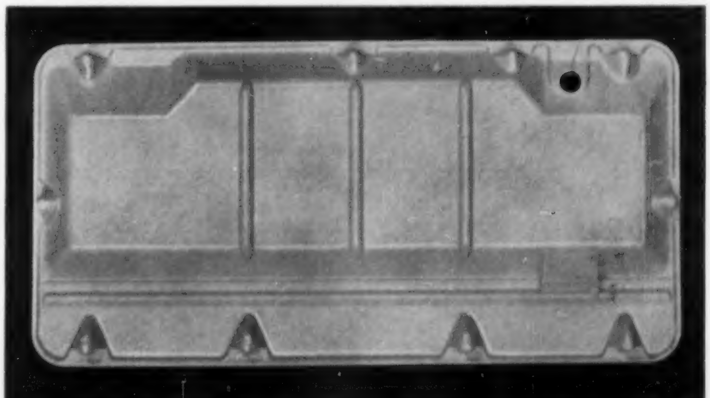
Early in 1954 an integrated sheet making and forming operation was set up, using a 3.5-in.-diameter, 17:1 (L/D) extruder and a manual 48- by 72-in., single-station, vacuum forming machine. The first part produced from this vacuum former was the small refrigerator back plate shown in Fig. 1, right. With the knowledge gained from vacuum forming this first part, the operation was expanded in Aug. 1954 to include the forming of a single 1955-model refrigerator inner door. By the end of 1954, the department consisted of three single-station hand machines with two sheet extrusion lines. These machines ultimately produced over 200,000 parts.

It was planned that all refrigerator models for 1956 were to be designed to use high-impact polystyrene inner doors. This large-scale application emphasized the need for a faster, more efficient vacuum forming operation which would eventually have to produce over 2,000,000 parts per year.

Cycle analyzed

Development work on the design of a small automatic vacuum former was completed in late 1954. The cycle on a hand machine at that time was one door every 2 min. or 30 doors per hour. To achieve our potential production with the limited space available required an automatic vacuum former whose output would be three times that of a single-station hand machine. F. V. Tarbell, one of G.E.'s advanced planners, pinpointed the requirements for a semi-automatic machine. On a hand-machine cycle there were four distinct operations: heating, forming, cooling, and part removal and sheet feed. Since the four phases are distinct and took

Fig. 1: Early refrigerator back plate, approximately 1 by 2 ft., produced from high-impact polystyrene sheet material on a hand-operated vacuum forming machine. (Photos, General Electric Co.)



*Reg. U. S. Pat. Office.
†Plastics Engineer, Major Appliance Laboratory, General Electric Co., Louisville 1, Ky.

roughly equal lengths of time, they could be automated to run simultaneously. The idea promised to reduce by over 50% the number of machines required to fulfill our production demands. Aside from this, there would be valuable savings in floor space and man power.

A pilot machine, built to evaluate this automatic principle, is shown schematically in Fig. 2, below. This unit has nine frames that travel around a long closed loop. It could form small parts up to 24 by 30 in. in area at a production rate of over 100 per hour. At the front end of the machine the operator loads the sheet and removes the finished part which has been returned to him overhead. The operator's time was completely utilized in loading and unloading this machine. This was in sharp contrast to the operation of a hand machine where the operator remains virtually unoccupied for two-thirds of the production cycle.

On the pilot machine, the frames were indexed from one station to the next by an air cylinder drive. A bank of timers control all the operations—the indexing, heating, forming, and cooling and air blow-off of the part. Although this machine proved to be a real production work-horse for two years, it had several faults. Having nine frames made mold setup difficult and hindered obtaining a consistent product. We decided that four frames would be sufficient to handle the four distinct operations.

Editor's comment: This article is a significant contribution to the engineering literature of the newest branch of the plastics industry at a time when a revolution in processing methods and machine design is taking place.

More than 50% of all aluminum and at least 30% of all steel is sold in sheets for forming, drawing, and stamping. The sale of plastic in rigid sheets will attain major proportions only when full automation in forming becomes the rule. The equipment and method described here constitute an important step in that direction.

Production unit designed

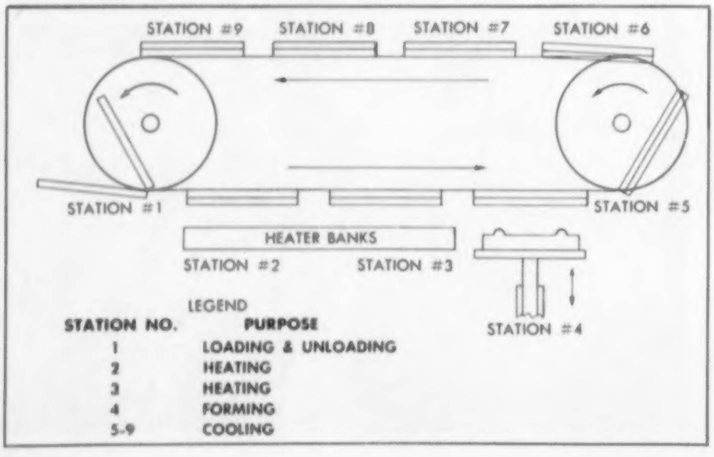
At that time, to our knowledge, the only automation in heavy-gage vacuum forming was a combined extrusion and vacuum forming machine on a continuous line that was basically designed for female forming. D. R. Edwards, another G.E. advanced planner, prepared the specifications for a larger unit having a frame opening size of 36 by 66 inches. This was the maximum size anticipated for inner doors. The first machine of this type went into operation in June, 1955.

These machines have a hydraulically driven, precision chain to which are attached four frames. The frames travel around the long loop, parts of which can be seen in Fig. 3, p. 121. All controls are located near the operator at the front end of the machine and the unit can be run either automatically or manually. The four stations or positions of the frames are shown in Fig. 4, p. 121. The heaters require a 5-min. warm-up period to reach proper forming temperature. Once the heaters are up to temperature, the operator places an extruded sheet in an angle-iron inner frame at Station 1. The bottom half of the frame is held stationary. The top half, which is hinged on the back, is opened to a 30° angle by the action of a hydraulic cylinder. (The chain cannot advance while the loading frame is open.) The operator locates the sheet in the correct position and presses a pair of buttons on the control stand to start the machine running. A hydraulic cylinder then lowers the top half of the frame to clamp the sheet into position. When the frame has been locked by the action of another cylinder, the unit starts to index to the next station. The frame now moves along the chain to the heating position, Station 2. The indexing time from station to station can be varied.

Sheath-style infra-red heaters with a total power of 132 kw. heat both sides of the sheet at Station 2. The distance of the heaters from the sheet is adjustable and the temperature is controlled by devices that keep the heat on for part of the cycle and off for the rest of it ("percent input timers"). Properly adjusted, such heaters give very uniform heating of the sheet. Close control of the level and uniformity of temperature is essential to good forming. Once the sheet is heated to the forming temperature of 310° F., the frame indexes to the third station.

In Station 3, the mold rises on a vertical lifting platen, contacting and sealing the sheet on all sides. When the draping and sealing action are completed, vacuum is applied through holes in the mold. The trapped air between the

Fig. 2: Schematic diagram (side view) of a pilot model automatic vacuum forming machine, showing its nine stations. In this experimental forming set-up, only one side of the sheet is heated



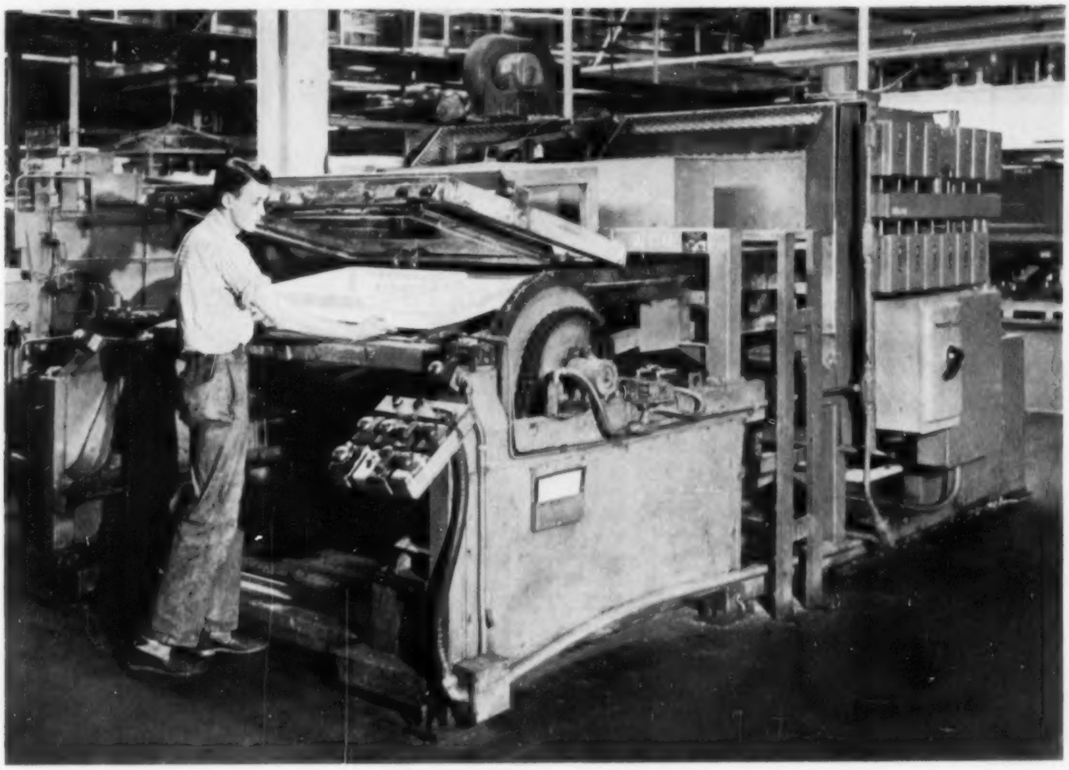


Fig. 3: Four-station automatic thermoforming machine in actual operation. (The machine can also be operated manually.) Operator is shown removing a finished refrigerator door liner which he will next swing around into a piercing and trimming press behind him (not visible in above photo). After trimming, he will hang both liner and trim on conveyors. (See Fig. 7, p. 126)

sheet and mold is evacuated, bringing the sheet into intimate contact with the mold and forming the part. A view of this station is in Fig. 5, p. 124. The forming station sets the time limit for the entire cycle. The time required to heat a sheet of 80- to 115-mil thickness is far less than that to cool the formed part (final thickness ≅ 50 mils) on the mold, so, in this case, the rate of output is limited by the time it takes to cool the part.

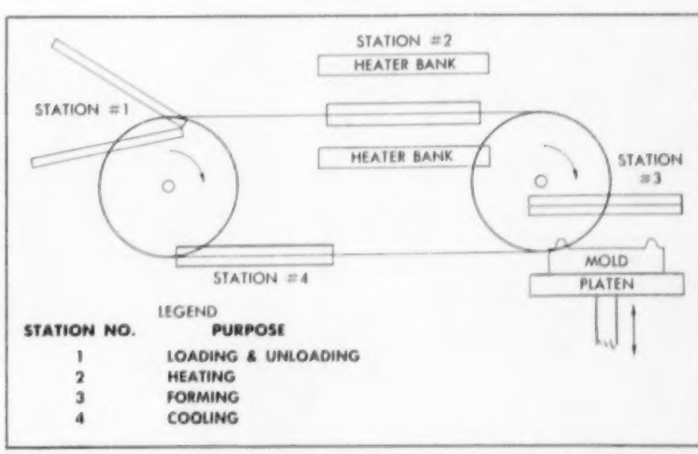


Fig. 4: Schematic side view of four-station machine. Note that this machine is designed so that both sides of sheet are heated

Timing

The time required to move a frame from one station to the next is called indexing time. The time necessary to form and cool the part on the mold is called the forming time. The total cycle consists of the indexing time plus the forming time. The various phases of forming are controlled by the seven timers in Fig. 6, p. 124.

All timers function from the same zero time. As the mold rises to the sheet in Station 3, it engages a limit switch which starts the action of these timers. The first timer resets all of the timers at the end of a cycle. Cam-operated lugs, used to form shelf supports, are controlled by the second timer and are in the forming position at zero time. The cams are not retracted from the cavity

(*To page* 124)

STOKES *news and views*

Model 741 Press Features Set New Performance Records

Weston Electrical Instrument Corporation, a subsidiary of Daystrom, Inc., gets real savings . . . improves quality

Phenolic flush cases for famous Weston meters are now being produced to new standards of economy, quality and uniformity. Since a Stokes Model 741 50-ton fully automatic compression molding press has been on the job, labor costs per piece have been substantially reduced. Overall production costs are now 20% lower . . . output per shift per operator has jumped 140%.

The 3½-inch-diameter meter cases are molded three at a time. A single press operates at a rate of 20 complete molding cycles every hour, 24 hours a day . . . a total production of more than 1400 meter cases daily. The design and construction of each Model 741 feeder exactly matches the requirements of the die with which it is used . . . affording minimum material usage and maximum production of quality parts.

This high production requires only a fraction of an operator's time. All the operator needs to do is load molding powder into the hopper, remove barrels of finished parts, and occasionally check on the functioning of the press. Simultaneous, cushioned action of feed and comb permits ejection of parts while new charge is being fed . . . maximum percentage of total press cycle is devoted to curing.

Write to Stokes today for Bulletin No. 506, "Stokes No. 741 Completely Automatic Plastics Molding Press", for full data on this complete molding plant . . . and for a consultation on how it can be profitably applied to your specific molding work.

Typical Weston meters: cases are molded at the rate of 1400 per day on a single Stokes Model 741 press.

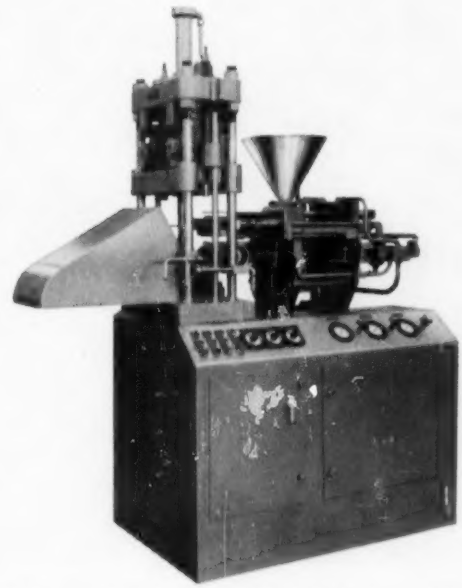
Close-up of parts leaving mold. Positive seal between feed and comb prevents parts or flash from falling back into die . . . a Stokes exclusive feature.

Model 741 press at Weston Electrical Instrument Corporation molds cases for 3½" meters completely automatically. Finished cases are sliding from chute into tote barrel. Operator can make all necessary machine adjustments from a single control panel.

# of plastics progress

Stokes injection machine introduces new concept to automatic molding

Features unique Stokes positive shut-off at nozzle, ideal for automatic nylon molding.



This machine brings new economy of tooling and labor to automatic injection molding. It is a complete, self-contained molding plant. It molds, de-gates, ejects and sorts automatically . . . even diverts runners to separate bins.

Saves labor. Only one-tenth of a man's time is needed. Manual unloading, de-gating and sorting are eliminated.

Low-cost molds. Simple, conventional dies are used . . . can be tailored to your own production needs. Short cycles give high output per cavity.

Fast cycles. Only 3½ seconds between mold opening and start of next fill.

Simple set-up. Conventional dies are easy and quick to set up; no complex tooling. Ideal for short runs.

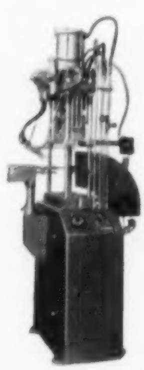
High uniformity. Quality of production is maintained, rejects reduced.

Space-saving design. Vertical design cuts floor space requirements, simplifies mold set-up.

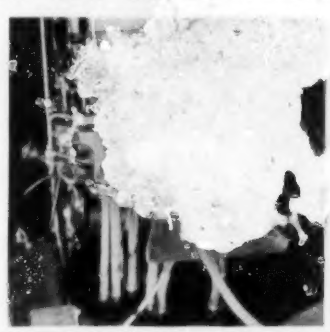
Unique Stokes feature of positive shut-off at the nozzle permits full-pressure pre-packing of the injection cylinder, assures uniform plasticizing, cuts cycle time.

For complete details on this new machine, write for your copy of Bulletin 565.

OTHER NEW STO[illegible]



Model #725 25-ton Automatic Compression Molding Press . . . designed for specific needs of short-run compression molding. Fast, flexible, fully automatic.



Rope Feeder for Glass-polyester pre-mix . . . lets you feed pre-mix in rope form directly from the spool into an automatic molding machine, in accurately cut lengths . . . eliminates manual handling.

Model #741 Automatic Compression Molding Presses . . . now available in 50, 75 and 125-ton capacities. Designed to produce at high production rates, at exceptionally economical cost.

Write today for information on these and other new developments by Stokes of interest to plastics molders.

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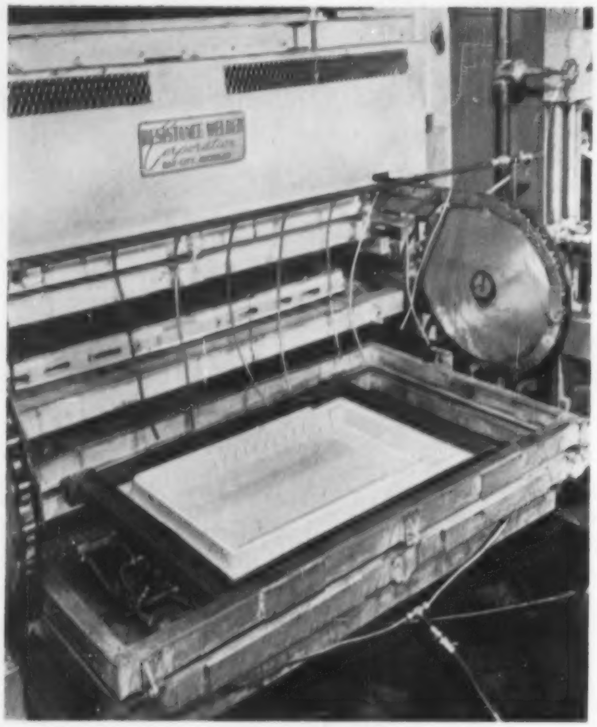

Fig. 5: Close-up of Station 3 of four-station automatic forming machine, showing a newly formed sheet under vacuum. Horizontal refrigerator shelf supports have been formed on cam-operated, retractable lugs

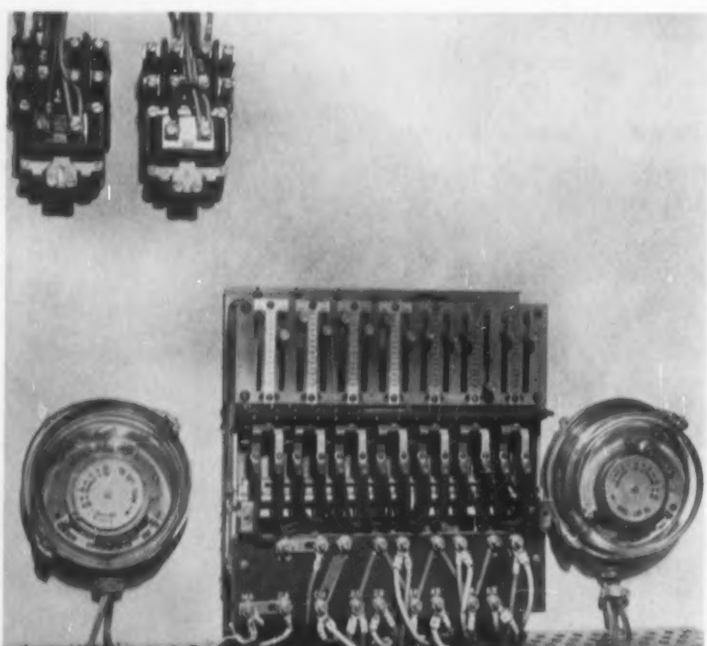

Fig. 6: Seven timers (center bottom) control the automatic forming cycle on the four-station thermoforming machine shown in Fig. 3, p. 121. They are located at the rear of the machine and are out of sight in Fig. 3. At end of cycle, the first timer resets all timers

until the formed sheet has had time to set and the vacuum has been released.

The third timer controls the time at which vacuum is applied and released. The 1-sec. delay on the vacuum timer allows for complete draping action before applying the vacuum. The fourth timer controls a blast of air across the part that helps to cool the part while it is in contact with the mold. It is delayed until 2 sec. after vacuum release so that the sheet will be formed solidly against the mold surface before the air blast, which might malform an unsupported sheet, is started.

The fifth or vacuum release timer is commonly referred to as the "air blow off" timer. After the mold vacuum is released, compressed air is injected through the vacuum holes, breaking the part free of the mold. The sixth or mold-release timer ends the over-all cycle; at this time the mold platen drops out of position, leaving the part free to index automatically to the next or final cooling station.

The last timer controls a warning horn near the operator. If the operator fails to load the machine on time, the sheet at Station 2 will be overheated and will form badly when it reaches Station 3. In effect, this horn is a pacing device for the operator.

Cooling the parts

All vacuum forming molds used here are water-cooled, pressure-cast aluminum. Although the greatest portion of the cooling is done while the part is still on the mold, at the fourth station the part is cooled through another cycle, with the aid of forced air. This extra cooling hardens the material sufficiently so that the operator can trim the part immediately after removal.

These automatic vacuum forming machines have been operating on a 24-hr. basis for over a year. To our knowledge, they were the first drape forming units capable of producing our type of inner doors at a rate of 80-100 doors per hour. One man can perform all the operations of the machine, trim and pierce the part in an adjacent hydraulic punch press,

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and hang it on a conveyor which runs to an assembly or storage area. A trimmed inner door is shown on a conveyor in Fig. 7, below. All trim material is returned on the same conveyor to a central granulator where it is reground and returned to the extruders for re-use.

A storage conveyor above the forming area will hold a 1½-day supply of inner doors for the assembly line. This is required to assure an uninterrupted supply of doors at the assembly plant. By vacuum forming our own doors we can maintain a great deal of flexibility in our final assembly operations. With an hour's notice we can change our production from one model to another. Furthermore, the automatic forming process gives much more consistent control of the operation, with a resulting lower rejection rate.

A typical door design is shown in Fig. 8, below. Almost all of our doors are a combination of male and female forming with high rib sections, shelf supports, and deep interior compartments. The deepest part we drape form presently is 5 in. deep. The stretch factor for the door shown in the illustration is 1.5:1. This stretch factor is the ratio of the finished part's area to that of the original sheet required to make the part.

Vacuum forming is a rapidly advancing field in which machine design is constantly changing. A machine designed one year may be entirely obsolete the next year. For example, the recent trend toward using plug-assist technique (see "Plug-Assist Forming—A New Sheet Fabrication Technique," by J. W. Mighton, Technical Papers, 12th Annual National Technical Conference of the S.P.E., 1956) as an improved method for forming deep female sections, has already resulted in significant changes in machine design.

Acknowledgment

The writer wishes to express his thanks to John Nasser, Major Appliance Laboratories, for his assistance in the preparation of this paper.

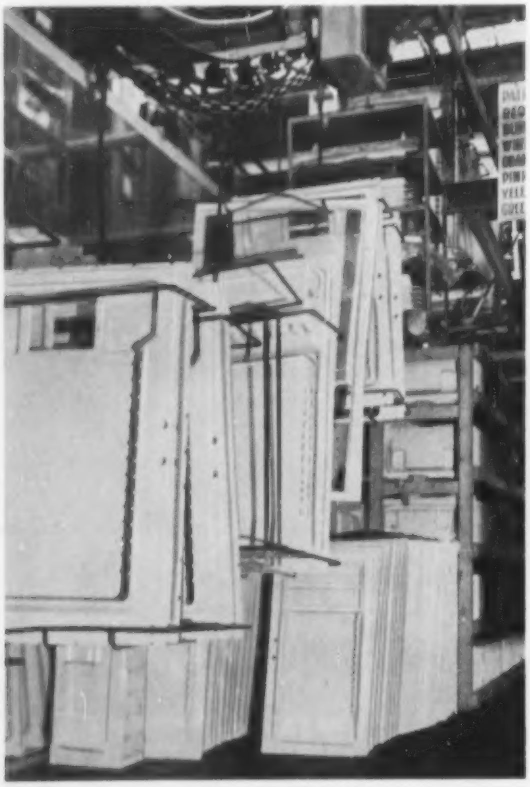
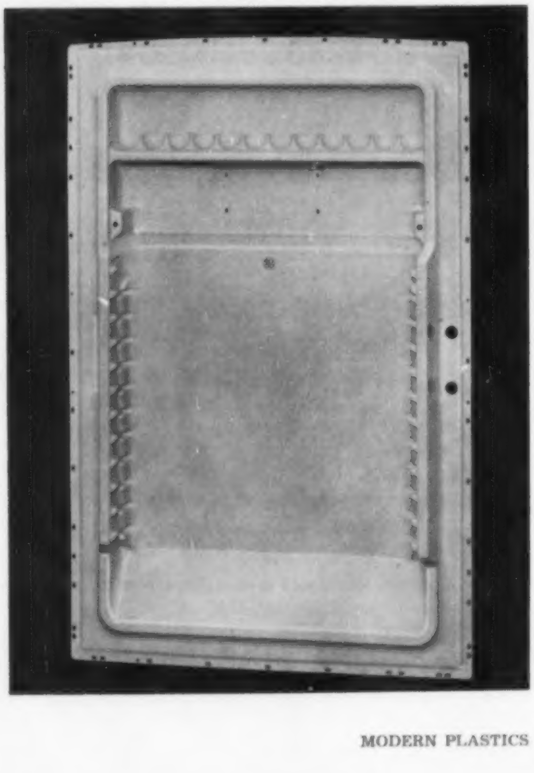


Fig. 7: Conveyors holding completed inner door liners and trimmed "picture frames." The trim is reground and extruded, along with new material, into sheet for forming

Fig. 8: Close-up of thermoformed inner door liner produced on four-station automatic machine. Dimensions of this liner are 2½ by 4 ft.; however, the machine is capable of forming objects as large as 3 by 5½ feet



Design and operation of

Crosshead sheeting dies

A severe sheet extrusion problem is the attainment of uniformity of caliper over the whole width of the sheet. Using the results of a recent mathematical analysis of melt flow in crosshead sheeting dies as a basis, a method is given that permits such dies to be designed very simply to make uniform film. The effects of the several die dimensions, placement of the feed port, and material properties on the performance of dies are discussed. The method applies to blown-film dies as well as flat-sheet dies, and has been followed through for a typical case. Some alternate methods of attaining uniformity are discussed.

Crosshead sheeting dies are widely used for the extrusion of plastics sheeting and flat and blown film. By a crosshead die, sometimes called a "manifold-type" die, is meant one in which the melt turns a corner as it enters the die from the extruder. A long-standing problem connected with such dies (and others) is the problem of getting uniform rates of extrusion over the whole length of the die slit. A difficult part of this problem has been the accurate adjustment of the slit depth; another part is the maintenance of uniform temperature over the whole die. These two obstacles are mostly mechanical and can be overcome by taking sufficient pains. Even then, there is still a uniformity problem because the pressure of the melt is higher at the feed end of the die and lower at points that are far from the feed end. This can be better explained with the help of Fig. 1, p. 128, which is a schematic drawing of a simple crosshead-slit die in which the feed enters at one end. Reduced to barest essentials, it is a thick pipe open at one end and plugged at the other, with a longitudinal slit along its whole length. As the polymer enters the open end, some of it is extruded at that end of the slit, while most of it continues along the pipe. The flow along the pipe is resisted by the drag of the melt on the pipe wall. Some of the available head is spent in overcoming this resistance, so the pressure drops as the melt moves along the pipe. The pressure outside the die lips, however, stays the same, and is generally the ambient atmospheric pressure. The further from the entrance, therefore, the smaller is the pressure drop available to force the melt through the slit. If the slit is of uniform depth and width, the local rate of extrusion at its far end must be less than it is at the feed end. If the sheet is drawn off at the same speed everywhere, then it must become thinner at the far end. This situation of unequal extrusion rates raises several questions: How great is the disparity? How is it affected by changes in die dimensions and polymer properties? How can dies be designed to give good uniformity in a given situation?

Before these questions could be answered, it was necessary to know how non-Newtonian melts behave in crosshead-slit dies. Many polymers obey the so-called power law fairly well. This is the law which says that at any particular temperature the rate of shear of the melt is proportional to a relatively high power of the shearing stress. For Newtonian materials the power is 1, while for non-Newtonians like polyethylene, polystyrene, and so on, it is usually in the range from 1.5 to 4. Equations describing the flow of such materials in crosshead dies have been derived and published (1)[1]. The final result of that analysis was a formula giving the uniformity index, or UI, of a die in terms of the die dimensions and the power of the shear stress which applies to the material in the die. An improved version of this formula (see Appendix), together with the equation relating the output of a slit die to the slit dimensions and the pressure drop, furnish a rational basis for die design.

Extruders of sheeting know that the elastic properties of the stock often influence the final dimensions of the film. With some materials, elastic strains are not fully recovered until the film is unwound from the roll by the customer. If this strain recovery is uneven the film will wrinkle and bulge and won't lie flat, and other troubles will arise due directly to non-uniformity of caliper.

There is evidence to show that the amount of strain recovery depends on the stress imposed on the melt in the die. If the stress were the same at all points in the die lips, the strain recovery, presumably, would be uniform over the whole sheet, and the trouble mentioned above would not arise. This would be the case if the die lips had the same width and were the same distance apart over their whole length.

On the other hand, it is a very common practice in the sheeting

[1] Numbers in parentheses link to references at end of article, p. 136.

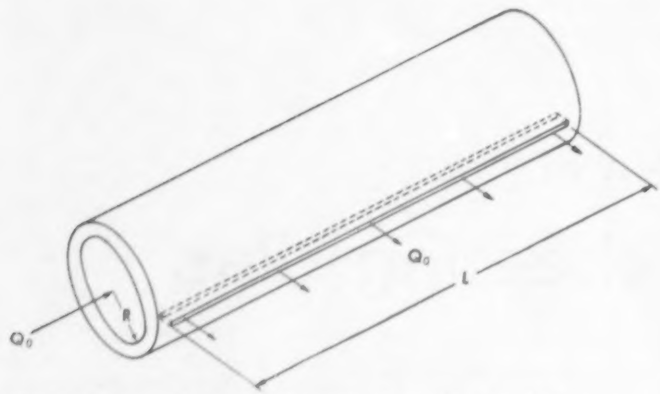


Fig. 1: Diagram of an end-fed, crosshead-slit die. Lip width t is measured in direction of small arrows emerging from lips.

industry to set the lips closer together at the feed end of the die than at the far end. This is done to offset the loss in pressure between those two points and thus improve uniformity of output over the slit length. It is evident that this practice causes uneven strain recovery in elastic stocks. If possible it should be shunned. There will be detailed here a procedure for designing crosshead-slit dies which will have the same slit width and depth over their whole length and will deliver a film of any desired uniformity short of perfection. In deriving the equations used it has been assumed 1) that the melt obeys the power law and 2) the temperature is the same over the whole length of the die.

The second condition is an important one and should be met to within 2° F. if local rates of extrusion are to differ by 5% or less. Perhaps the surest way to accomplish this is to enclose the entire die with an insulated jacket through which a heating medium (e.g., high-pressure water, or Dowtherm) is circulated at high speed. To attain such control with zoned band heaters requires special care in making the installation. The thermocouples used for the different zones, for example, should be as closely matched as possible and should be calibrated in the range of interest. It is doubtful that the general run of on-off controllers can handle this job satisfactorily. The control instruments, too, must be checked periodically. If the band heaters are not well protected from air currents with glass wool or other insulation, their operating temperatures will change, upsetting the temperature distribution in the metal. The body of the die must be extended well beyond the ends of the lips and the end faces heated, too, if the temperature is to be kept uniform to the ends of the lips. The higher the operating temperature, the more difficult does it become to attain the allowable spread in temperature of 20° F. (±1° F. around the control point).

The design equations

Some of the descriptive terminology connected with slit dies needs clarification. The slit itself has a long, flat, plank-like shape. It is therefore defined by three dimensions. In describing slit dies, the term "width" has been used to mean any of these three dimensions. Here the length, width, and thickness, or depth, are used in just the way a plank is described. The width is therefore measured parallel to the direction of flow through the slit, while the length is parallel to the direction of flow along the circular feed channel behind the slit.

Also of concern is the drop in pressure across the lips. Since the pressure outside the die is rarely anything but the local atmospheric pressure, the pressure drop is equal to the gage pressure of the melt on the inside of the die manifold.

The equations needed for designing dies follow:

$$t = \left[- \frac{f_0 L h^{n+2}}{2^{n+1} (n+2) Q_i} \right]^{-\frac{1}{n}} P \quad \text{Eq. 1}$$

where L, t, and h = the length, width, and depth of the slit, in inches. For a center-fed die, L = half the total length of the die; for an end-fed die it is the entire die length.

P = the melt pressure behind the lips, p.s.i.g. For dies of acceptable uniformity P is so nearly equal to P_i, the entering melt pressure, that P can be taken as equal to P_i in using Eq. 1.

n = the exponent of the stress in the power law; it is peculiar to the material and has no dimensions.

f_o = the "generalized fluidity" of the melt at the extrusion temperature (sec.)$^{-1}$; f_o is equal to the shear rate when the stress is equal to the "standard-state" stress, in this case 1 p.s.i. The standard-state stress may be any convenient unit stress, but its dimensions must be consistent with those of the other factors in the equation.

Q_i = the flow of melt per branch of the die at the feed end, in.^{3}/sec. The negative sign in the equation arises from the fact that the direction of the pressure gradient was taken as positive and the flow has the opposite direction. Thus the normal outward flow will always have a negative sign. Since extruder outputs are usually thought of as positive numbers, the flow and the output will have opposite signs. For an end-fed die, $Q_i = -Q_o$, the output of the extruder; for a center-fed die, $Q_i = -Q_o/2$. For all practical purposes, then, the two negative signs will annul each other and the final quantity in brackets in Eq. 1 will, therefore, always be a positive number.

It was shown (1) that a certain combination of the die dimensions and the exponent n, symbolized by the Greek letter α, was closely related to the uniformity index (UI) of the die. The UI is defined as the ratio of the local extrusion rate at the far end to that at the feed end of the die. It is therefore a direct measure of the variation in caliper from the center to the edge of the sheet. *It is the central theme of this article that a sound die design should start with the required UI.* It is convenient to work with a

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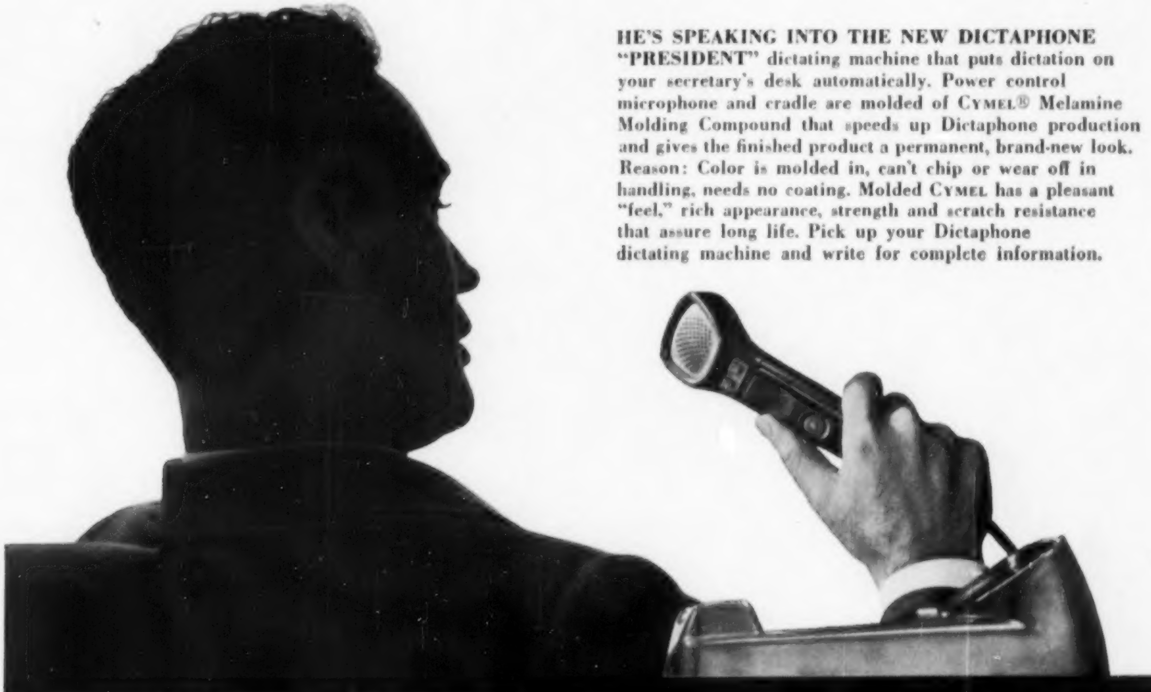

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function of the UI, called u, and defined by the equation

$$u = 1 - (UI)^{\frac{n+1}{n}} \qquad \text{Eq. 2}$$

This function, in turn, is important in a third equation from which the quantity α may be determined.

$$\alpha = \frac{u^{\frac{n}{n+1}}}{L}\left[\frac{1}{n} + \frac{u}{2n+1} + \frac{u^2}{3n+2} + \frac{u^3}{4n+3} + \dots\right] \qquad \text{Eq. 3}$$

The parameter α is independent of the fluidity of the extrudate and is only dependent on extrusion conditions to the slight extent that n is influenced by them. It has the dimension (in.)$^{-1}$. For the purpose of die design (as opposed to analysis of die performance), the equation defining α has been solved for the important dimension R, the radius in inches of the feed channel behind the die lips. The result is

$$R = \left[\frac{(n+3)\, h^{n+2}}{2\pi n\, (n+2)\, t^{n}\, \alpha^{n+1}}\right]^{\frac{1}{n+1}} \qquad \text{Eq. 4}$$

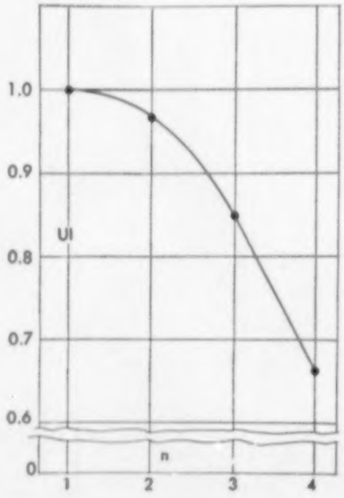
These four equations, together with the requirements of the situation and the flow properties of the melt, are sufficient to set all the inside die dimensions. While the series in Eq. 3 theoretically contains an indefinite number of terms, the ones given are all that are needed for the design of practical dies. This is so because the UI desired is usually near 1, say 0.95, so u is a small number, about 0.1, and its rising powers rapidly grow smaller.

Design for UI actually needed

The equations permit the designer to specify die dimensions that will give any desired degree of uniformity. However, there are good reasons why he should not call for a UI much higher than that actually needed. For all commonly encountered values of n, u will get smaller as the UI approaches 1.00, its theoretical limit for a die of fixed slit width and depth. As u gets smaller, so do all the terms of Eq. 3, and so does α. From Eq. 4 it can be seen that as α decreases, other factors remaining the same, R will increase. Now, as the radius of the feed channel grows larger, several problems arise. First, it becomes harder to keep the temperature constant over the larger die surface. Second, the volume of the channel increases as the square of the radius and so does the hold-up time. This is an important consideration for some materials, e.g., the vinyls, though not so important for such others as polyethylene. Third, and worst, has to do with the bending of the die metal under the pressure of the melt.

A cross-section of the die looks like a fat letter **C**, with the melt pressing radially outward in all directions. This pressure adds up to a tremendous force that bends the die, causing the slit opening to widen. The amount of bending, for a given pressure, is proportional to roughly the third power of the channel radius R. This bending is not uniform but is worst at the center and even worse in center-fed dies. If the increase in slit depth caused by bending is uneven by as much as 1% of the depth, the UI will be significantly reduced. Thus anything that can be done to minimize the bending should be done. The radius R should be no larger than necessary, the thickness of the shell must be large, the die metal should be stiff, and the temperature should be as high as the thermal stability of the melt and its draw properties will allow so that the pressure can be kept down. Demanding too high a UI, with the resulting large radius, could, paradoxically, result in a *low* UI in actual practice!

Fig. 2: Effect of flow exponent n on UI of 48-in., center fed die



Why try for uniformity?

Uniformity of caliper is important to good winding, to flatness of the sheeting when it is unwound after storage on a roll, to heat sealing, and to many consumer applications. A certain minimum thickness is needed in a bag, for example, which is to hold a dozen oranges. Any greater thickness wastes polymer and raises the cost. To meet this minimum-caliper specification with a UI of 0.85 requires that about 7% more polymer be extruded per yard of film than is actually needed. Production stoppages in fabricating equipment can be expensive in terms of film and labor wasted. An important reason for using high draw ratios in making polyethylene film is to get the caliper control that present dies fail to give. And high draw has disadvantages of its own: 1) It subjects the film to stresses only a little less than its tensile strength in the molten state. Slight local imperfections, setting up stress concentrations, can easily start tears. The high stresses are frozen in during quenching, leading to creep later on. 2) High draw causes a substantial reduction in the width as well as the caliper of the sheet. This requires that the dies be still longer, exaggerating caliper control problems, and it makes control of width more difficult so that trim allowances must be larger. High draw from relatively thick slits does have the advantage that lower melt pressures are required, but, since the extrusion rate is proportional to the nth power of the pressure, a 5- to 10-fold increase in rate can be obtained by merely doubling the pressure.

How design factors affect uniformity

The exponent n is important in all four equations, and has a strong influence on the UI, for a die of given dimensions. The greater the deviation from Newtonian behavior—that is, the larger n is—the poorer the uniformity and the lower the UI. To

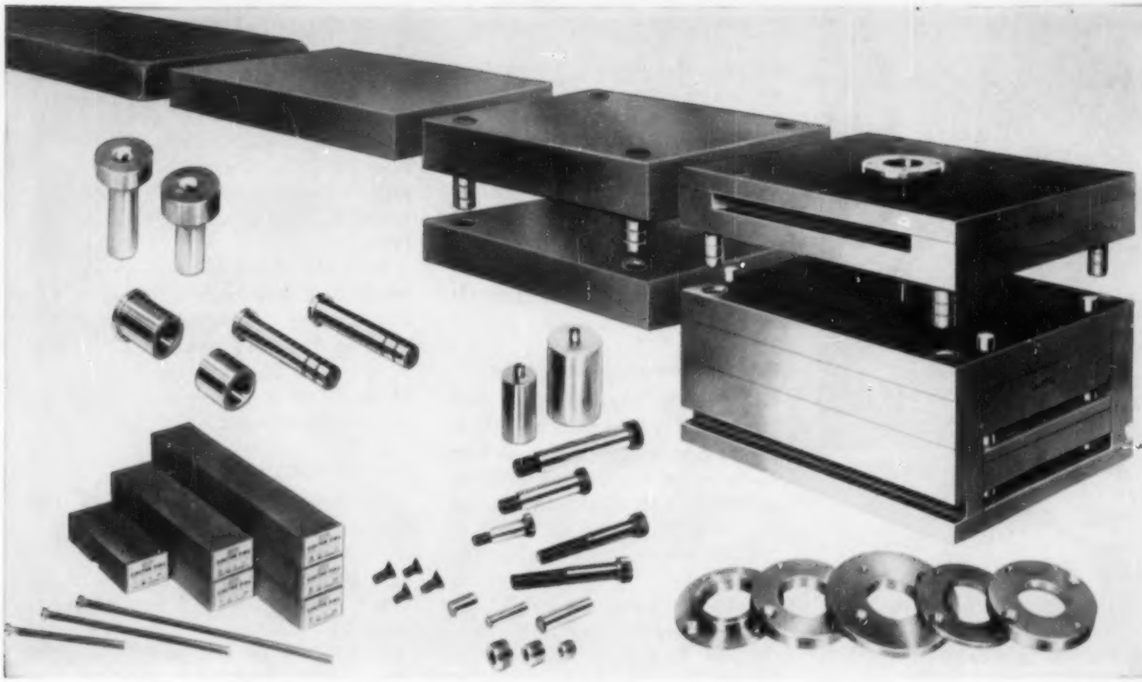


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Fig. 3: Crosshead blown-film die in operation (Photo, Du Pont)

show the importance of n, the UI was calculated for materials of $n = 1$, 2, 3, and 4 flowing through a typical film die. The die is 48 in. long, center-fed, so the length for the calculations is 24 inches. The other dimensions are $h = 0.01$, $R = 0.75$, $t = 0.50$ inch. For each n, α was calculated from Eq. 4 and the UI was calculated from α.[2] The results are shown in Fig. 2, p. 130. For materials having stress exponents in the range 1 to 2.2, this die will be satisfactory. But if n were 3, undrawn film from this die would be 15% thinner at the edges than in the center! Branched polyethylenes, the common kind, have n values in the neighborhood of 2.8.

The length of the die, also, is important to uniformity. The greater the length L, the poorer the uniformity. For this reason a center-fed die is nearly always preferable to an end-fed die of the same total length. If the 48-in. die discussed above was end-fed instead of being center-fed, the UI for $n = 3$ would be 0.69 instead of 0.85, a much poorer uniformity.

Blown-film dies

The equations given also apply to certain dies for making blown tubing, such as the one shown in Fig. 3, above. A half-section of such a die is sketched in Fig. 4, p. 134. Here the melt enters a doughnut-shaped channel and passes out through the annular slit which runs around the top of the doughnut. This is equivalent to a center-fed, flat-sheeting die which has been bent around a center and which has no ends. If the ratio of the radii R/R' is 0.2 or less, the formulas above apply with little error. For the die length L, $\pi R'$ must be substituted; nothing else is changed.

[2]For estimating the uniformity index of an existing die, it is easier to use the equation given in the abstract of Ref. 1 than the equations given here. But for designing new sheeting dies, Eq. 3 is more useful.

Preliminary considerations

Ordinarily the designer will have decided how wide and thick the finished film is to be and how much he expects to draw it down in width and thickness during draw-off. Thus the slit depth h and the length L are fixed at the start, and it is only necessary to find the values of the lip width t and the channel radius R. Presumably he will know what difference in caliper between center and edge is tolerable. The acceptable ratio of edge caliper to center caliper may be used for the UI in Eqs. 4 and 3 to calculate u and α.

If the die is to be used with an existing extruder and screw, the pressure *vs.* output characteristic of the extruder may already be known. If not, it can be estimated (2). If the die is part of an all-new installation, a lower total cost can be reached by designing the die and the extruder jointly. Reference 2 will be of some help, in that, also, together with the material presented here. For the present purposes, it is reasonable to assume that, for the desired output, the pressure that the extruder can attain will be known. Thus the extrusion rate Q_o and the gage pressure P in the die are given.

It should be kept in mind that Q_o is larger than the volume of finished film extruded per second because the hot melt is less dense than the chilled sheeting. Materials suppliers can often furnish data on density at melt temperatures, but if the melt density is not known, it may be assumed to be about 20% less than the cold density.

To determine the slit width t from Eq. 1, one must also know the flow properties f_o and n at the extrusion temperature. They are obtained from rheometric measurements made in an orifice-type rheometer at temperatures and stresses near those to be expected in the die. Such measurements have been discussed—with some different symbols—(3), and more will be said about them later.

With the above information at hand, it is now possible to step through the four design equations in the order given to get t, u, α, and R. The calculations can be made on a log-log slide rule or with logarithms.

Die design

For designing crosshead-sheeting dies the following procedure is recommended:

1) Decide what the extruded film thickness, the die length, the available melt pressure, the output, and the UI are to be. The film thickness will be equal to the caliper of the finished sheeting multiplied by the draw ratio.

2) Determine n for the polymer in question, as well as the value of f_o for the extrusion temperature. Information on these quantities can frequently be gotten from the material supplier (3). A manufacturer of dies, on the other hand, should own and use an extrusion rheometer. Where the information is unavailable, a single-point measurement *at the extrusion temperature* will yield a dubious value (but better than none) for f_o if n is assumed to be 3. A more conservative procedure, when only a single point is available, is to assume $n = 2.5$ when calculating f_o from the measurement and then use $n = 3.5$ in designing the die. At best, a point measurement is a poor compromise for more complete information.

3) Entering Eq. 1 with P, Q_i, h, n, L, and f_o, find t.

4) With Eq. 2, calculate u from the UI and n.

5) Using n, u, and L, find α from Eq. 3.

6) Entering Eq. 4 with n, h, t, and α, calculate R. The essential dimensions are now fixed.

To illustrate this procedure, suppose that a die is needed for an extruder which is to deliver 500 lb./hr. of polyethylene at a

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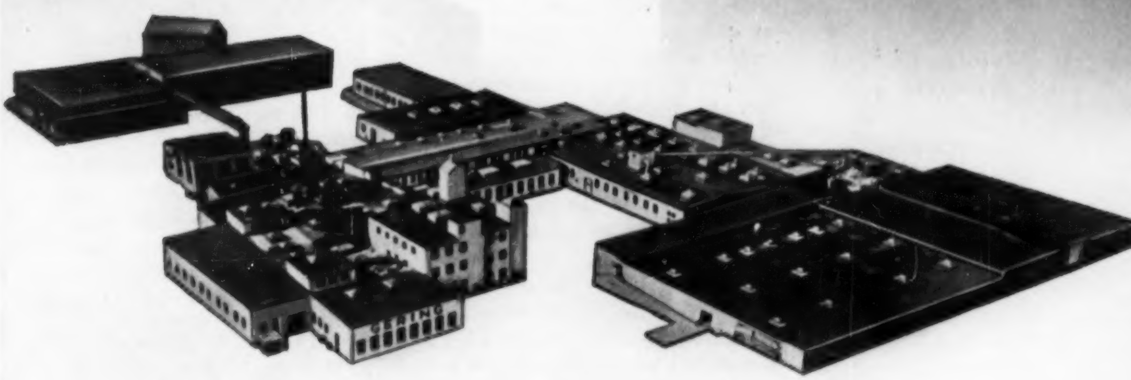

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pressure of 1000 p.s.i. and a temperature of 200° C. A UI of 0.95 is wanted. For polyethylene $n = 2.8$ and $f_o = 3.4$ (sec.)$^{-1}$. The extruded film is to be 10 mils thick at the die and the sheet must be 52 in. wide before drawing. The die will be center-fed. Since consistent units are required for these equations, the extruder output must be converted to cu. in./sec. The density of polyethylene at 200° C. is 0.0278 lb./cu. in., and there are 3600 sec. in 1 hr., so the extruder output is 500/ (0.278×3600) = 5.00 cu. in./sec. In the symbols of the equations, these statements become:

(Step 1)

$Q_o = 5.00$ cu. in./sec.

Then $Q_i = Q_o/2 = -2.50$ cu. in./sec., since the die is center-fed.

$$P = 1000 \text{ p.s.i.}$$
$$h = 0.010 \text{ in.}$$
$$L = 52/2 = 26 \text{ in.}$$

(Step 2)

$$n = 2.8;$$
$$\text{at } 200^\circ \text{ C. } f_0 = 3.4 \text{ (sec.)}^{-1}$$

(Step 3)

$$t = \left[-\frac{3.4 \times 26 \times (0.01)^{4.8}}{2^{3.8} \times 4.8 \times (-2.5)}\right]^{\frac{1}{2.8}} \times 1000$$

$$= 0.297 \text{ in.}$$

(Step 4)

$$u = 1 - (0.95)^{\frac{3.8}{2.8}}$$
$$= 0.0672$$

(Step 5)

$$\alpha = \frac{(0.0672)^{\frac{1.8}{3.8}}}{26}\left[\frac{1}{2.8} + \frac{0.0672}{6.6} + \frac{(0.0672)^2}{10.4} + \frac{(0.0672)^3}{14.2}\right]$$

$$= \frac{0.1366}{26}\left[0.3571 + 0.0102 + 0.0004 + 0.00002\right]$$

$$= 0.00193 \text{ (in.)}^{-1}$$

(Step 6)

$$R = \left[\frac{5.8 \times (0.010)^{4.8}}{2 \times 3.142 \times 2.8 \times 4.8 \times (0.297)^{2.8} \times (0.00193)^{3.8}}\right]^{\frac{1}{5.8}} = 1.52 \text{ in.}$$

Thus it has been found that $t = 0.30$ in., $R = 1.52$ in. If the extruder could deliver the melt at twice the given pressure (2000 p.s.i.), t would be 0.60 in., R would be 1.09 in., and the hold-up time of the melt in the die would be only half as great as it is at 1000 p.s.i. The chances are that to get the higher pressure a bigger extruder would be needed (2), and the reduction in hold-up, for polyethylene, would not be worth the added investment and operating costs.

Alternative designs

It was noted earlier that it is possible to obtain uniformity by variation of either the depth of the slit or its width. In some cases an already existing extruder has such a poor output-pressure characteristic that it can deliver an acceptable output only if the terminal pressure is small, that is, if the die resistance is small. With die lips of reasonable width, a very large channel radius may be needed to get uniformity with so little available pressure drop, and the die would become unwieldy. In such cases, it is possible to make the die lip wider at the feed end than at the far end, to compensate for the drop in pressure. This has two advantages over varying the slit depth: 1) the shear stress is constant over the whole length, and 2) the uniformity of flow is much less sensitive to errors in lip width than to errors in depth. Inspection of Eq. 1 reveals that if the slit width t is made directly proportional to the melt pressure at all points along the die, perfectly uniform extrusion rates should result. This means that the output per unit of die length is constant, that is, dQ/dz, which in the original analysis was allowed to vary within the given UI limit, is now set equal to Q_i/L.

The problem now is to find the equation giving the lip width t in terms of z, the distance coordinate in the lengthwise direction. From this equation a table of cuts to be made can be set up for the die maker. The assumption of uniform extrusion rate results in a new differential equation that is easily solved by elementary methods. The results are two new design equations. The first is almost identical with Eq. 1.

$$t_i = \left[-\frac{f_0 L h^{n+2}}{2^{n+1}(n+2)Q_i}\right]^{\frac{1}{n}} P_i \quad \text{Eq. 5}$$

where t_i = the lip width at the feed entrance.

P_i = the entering melt pressure, p.s.i.g.

$$t = t_i - \left[\frac{L^{n+1} h^{n+2} (n+3)}{2\pi (n+2) R^{n+3}}\right]^{\frac{1}{n}} \times \left(\frac{n}{n+1}\right)\left[1 - \left(\frac{z}{L}\right)^{\frac{n+1}{n}}\right] \quad \text{Eq. 6}$$

where t = the lip width at any point z along the die, in. z increases from 0 at the far end of the die to L at the feed end.

Equation 5 gives the initial lip width, while Eq. 6 gives the variation of lip width with z. Steps 1,

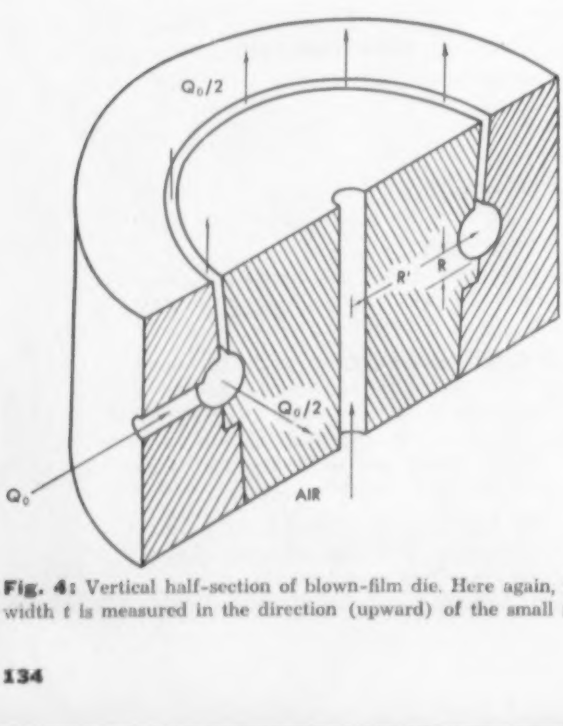

Fig. 4: Vertical half-section of blown-film die. Here again, the lip width t is measured in the direction (upward) of the small arrows

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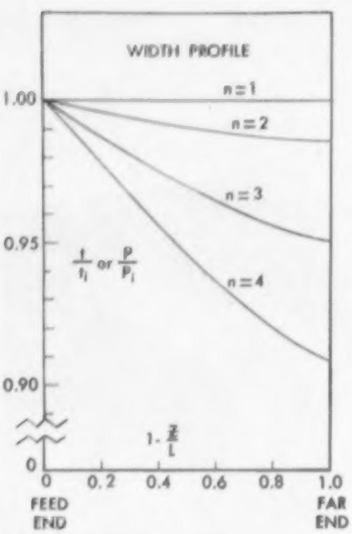

Fig. 5: Lip-width profile for die where large pressure drop is unavoidable

2, and 3 of the design procedure are as before but Eq. 5 is used in place of Eq. 1 to get the *initial* lip width. The channel radius may be chosen arbitrarily.[3]

(Step 4) Entering Eq. 6 with R, h, n, L, and progressive values of z/L, corresponding values of t may be calculated. The essential dimensions are then fixed. A graph of t/t_i versus $1 - z/L$, so calculated, is called a "width profile." As an example of such a profile, these calculations have been made for the center-fed 48-in. die mentioned above, for $n = 1, 2, 3$, and 4, assuming f_0, L, P_i, etc., remain the same. The results are plotted in Fig. 5, above. Since t is directly proportional to P at all points $t/t_i = P/P_i$, and the ordinate of Fig. 5 also gives the attenuation of pressure along the die. Since R here is 0.75 in., a fairly reasonable size, the variation in t is not large. If R were half this value, t/t_i at the far end would be only 0.6 for $n = 3$.

Variation of slit depth

From a practical operational standpoint, the adjustment of the slit depth, with all its disadvantages, may be the only way to try to achieve uniformity, particularly with already-existing dies. In such cases it would be useful to know exactly what adjustments of the lip aperture must be made to get uniform extrusion. Assuming there are no elastic effects, the approach used to find the width profile may be applied almost unchanged to get a "depth profile" when the width is held constant at $t = t_i$. Restating Eq. 1 in terms of h rather than t, the pressure at any point is inversely related to the depth by:

$$h^{\frac{n+2}{n}} = \left[- \frac{f_0 L}{2^{n+1}(n+2) Q_i t^n} \right]^{\frac{1}{n}} P \qquad \text{Eq. 7}$$

If t, etc., are kept constant,

$$\left(\frac{h}{h_i}\right)^{\frac{n+2}{n}} = \frac{P}{P_i} \qquad \text{Eq. 8}$$

where h_i = the slit depth at the feed entrance, inches.

The ordinate of Fig. 5, P/P_i, also represents $(h/h_i)^{-(n+2)/n}$ when t is fixed. To get h/h_i for a particular $1 - z/L$, read the corresponding ordinate off Fig. 4 and raise it to the $-n/(n+2)$ power. Multiply this by the initial depth h_i to get the value of h corresponding to point z. For example, suppose that you wished to know for this die what h should be at $z = 12$ in., the halfway point. Then, since $L = 24$, $1 - z/L = 0.5$, and from Fig. 5, for $n = 4$, $P/P_i = 0.945$. Thus h at $z = 12$ is $1.038 \times 0.010 = 0.01038$ in. or 10.38 mils. Such small adjustments are difficult to make accurately: it can hardly be hoped to get it correct to even the nearest 0.1 mil, which in this case would cause at least a 5% error in uniformity.

Variation of temperature

In the case of an existing die with too small a feed channel, it is theoretically possible to make up for the loss in pressure by heating the melt a little as it goes from feed end to far end. This increases its fluidity. A fluidity profile similar to the width and depth profiles can be worked out. However, the actual production of this profile in the real melt within the die involves a staggering complex of temperature-control, heat-transfer, and melt-behavior factors. It is very possible that, even if the solution could be worked out, it would turn out that the very thickness of the die wall needed to minimize bending would make it impossible to establish the required, rather special temperature gradient. At present this is no way to do the job. It is far better to maintain as uniform die temperatures as possible and to obtain uniformity of caliper by one of the other methods already discussed.

Appendix

The present form of Eq. 3 is due to H. E. Fettis, who showed in a private communication that the central integral of Ref. 1 had an exact solution. This solution, Eq. 3, is 1 or 2% more accurate than the one given in Ref. 1, and is more convenient for design purposes. The original integral was

$$\alpha L = \int_0^{\epsilon} \frac{d\nu}{[(1-\nu)^{n+1} - (1-\epsilon)^{n+1}]^{\frac{1}{n+1}}}$$

Mr. Fettis made the substitutions

$$(1-\nu)^{n+1} = (1-\epsilon)^{n+1} \sec^2 \phi$$
$$\text{and } (1-\epsilon)^{n+1} = \cos^2 \theta$$

thus transforming the integral to

$$\alpha L = \frac{2}{n+1} \int_0^{\theta} \frac{(\sin \phi)^{\frac{n-1}{n+1}}}{\cos \phi} d\phi$$

It has been shown that this integral can be expressed by the following series in $\sin \theta$ (4):

$$\alpha L = (\sin \theta)^{\frac{2n}{n+1}} \left[\frac{1}{n} + \frac{\sin^2 \theta}{2n+1} + \frac{\sin^4 \theta}{3n+2} + \ldots \right]$$

Equation 3 is a slightly modified form of this series.

References

1. Carley, J. F., "Flow of Melts in 'Crosshead'-Slit Dies; Criteria for Die Design," J. Appl. Phys. *25*, 1118 (1954).
2. Carley, J. F., McKelvey, J. M., *et al.*, "Symposium on the Theory of Extrusion," Ind. Eng. Chem. *45*, 969-93 (1953).
3. Tordella, J. P., "The Flow of Plastics Melts through Dies," SPE Journal *9*, 6 (May 1953).
4. Fettis, H. E., "On the Calculation of Integrals . . ." J. Math. & Phys. *33*, 283 (1954).

[3] The restriction on the original analysis that the ratio of the pressures at the far end to that at the feed be equal to or greater than 0.9 does not apply here. On the other hand, if R is taken very small, so that the drop along the channel is a large part of the entering melt pressure, any slight differences in slit dimensions along the die will have exaggerated effects on uniformity of discharge. R should be large unless holdup of the melt or bending of the die is important.

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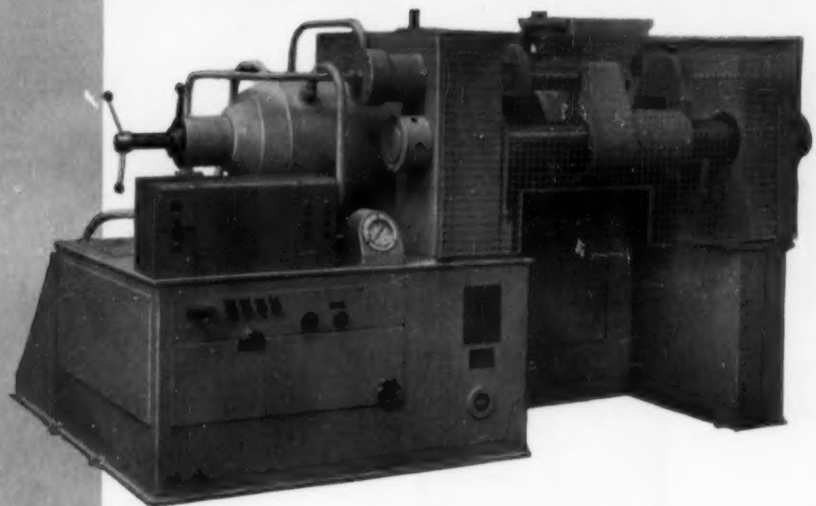

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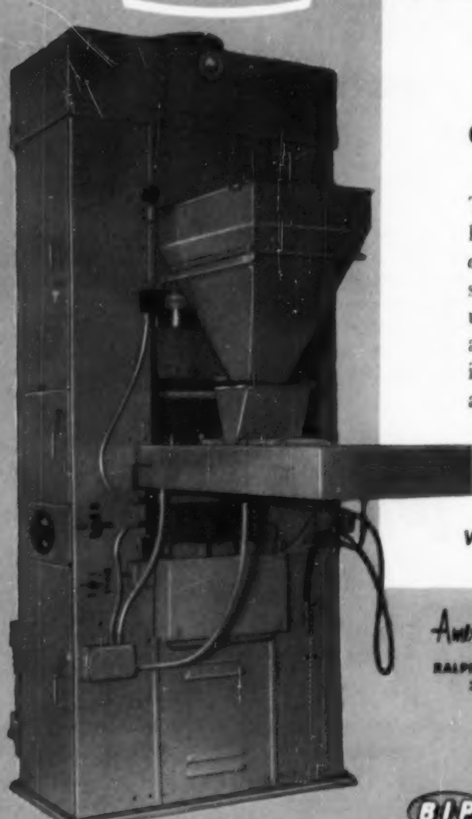

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Plastics* Technical Section

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Mechanical action of flexible foams

By R. H. Carey† and E. A. Rogers†

Coincident with the present developments in flexible plastic foams, there has been a growing demand for information on new foam-testing methods as well as information concerning the applicability of existing tests. This paper describes some test methods that may be useful. Up to this time, these methods have been used to study the behavior of rubber, urethane, and vinyl foam samples. No effort has been made to present test results on a variety of foam formulations nor on foams made under differing production conditions. The general behavior of urethane and vinyl foams when tested by standard rubber testing procedures is discussed, and several new tests, particularly appropriate to plastic foam, are described. Development work is continuing on these materials, and indications are that new techniques and formulations presently under consideration will result in improved mechanical properties, particularly for the vinyl foams.

Cell structure, of course, represents a vital factor in studies of the mechanical behavior of any foam. Figures 1, 2, and 3, p. 140, are photomicrographs of the commercial rubber, urethane, and vinyl foam described in this report. These illustrations are presented merely to describe the general nature of the materials used. It should not be construed that all rubber, urethane, or vinyl foams are the same as those illustrated. Qualitatively, an examination of these photomicrographs shows that rubber has many broken or unformed cell walls, vinyl has fewer of these, and urethane has the least. Also, the rubber and vinyl products are characterized by both thick and thin walls while, on the other hand, the urethane has primarily a thin wall structure.

This report presents compression-indentation data obtained on these three foams as well as a limited amount of data on compression set, flammability, and fatigue. This investigation has also indicated that fusion or "cure" is of great importance, and several test methods for use in attacking this problem are described.

The compression-indentation procedure described for use with flexible foams employs a Baldwin testing machine. It operates at 23° C. and 1 in./min., with a 50-sq. in. circular indentor for applying loads to a 12- by 12- by 1-in. specimen. Compression values at 50% deflection after a 1-min. dwell are used as measures of stiffness. However, "yield index" (load at 50% deflection divided by load at 10% deflection) may be a more useful and informative number. Hysteresis losses at 23 and 60° C. are illustrated and discussed.

The degree of recovery (of the original compression-deflection values) after flexing 290,000 cycles is shown at various stages of rest up to 600 hours. The rubber foam recovered immediately, while the urethane sample was appreciably softer after flexing. The vinyl sample was intermediate.

For investigating flammability, the test suggested by the S.P.I. Cellular Plastic Committee gave the following results: the rubber sample burned with alacrity; the urethane and vinyl foams were self-extinguishing with a slight advantage for the urethane.

The standard rubber compression-set test (50% at 70° C. for 22 hr. followed by recovery at room temperature for 1 hr.) indicates that the rubber and urethane samples have approximately the same residual set (5% or less). The vinyl foam, on the other

*Reg. U.S. Pat. Off.
†Development Department, Bakelite Co., a Div. of Union Carbide and Carbon Corp.

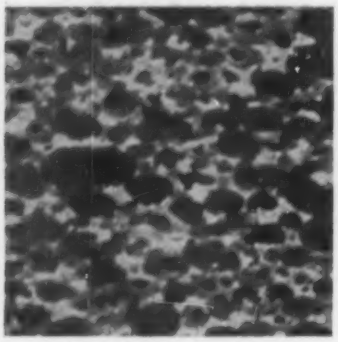

Fig. 1: Rubber foam magnified 16 times. Foam is characterized by large range of cell sizes. Note broken cell walls and small cells in the wall structure

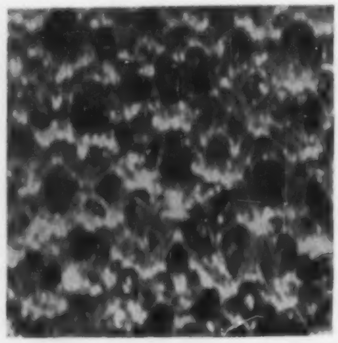

Fig. 2: Urethane foam, magnified 16 times. Foam is characterized by small cell structure. Note thin cell walls and the absence of broken cell walls

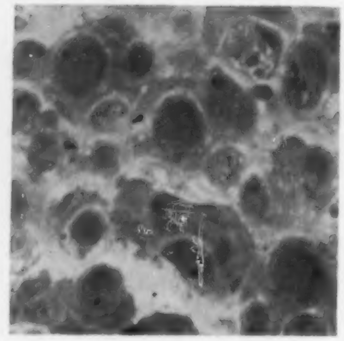

Fig. 3: Vinyl foam, magnified 16 times. Foam is characterized by thin and thick walls. Note coarse cell structure and presence of some broken cells

hand, had a much greater set (20%). When the samples are permitted to recover at 70° C. for 1 hr., the set of the vinyl sample is reduced to approximately 12% and after 22 hr. at 70° C. it is reduced to 8 percent.

Tensile strength measurements of ⅛-in. slices of a special sample of vinyl foam show the degree of fusion as a function of depth in the slab. Samples, both untreated and treated with ethyl acetate, were subjected to tensile tests. Also, a "constant strain" test was carried out to determine the maximum strain the material can undergo without failure when wet with ethyl acetate. It has been suggested that this test might be used to evaluate fusion. However, the preliminary results of this work, although promising, have not indicated the optimum degree of fusion for maximum quality.

It was found that electrical measurements of dielectric constant, dissipation factor, and loss factor are not capable of distinguishing between different degrees of "cure." The mechanical tests are apparently more sensitive, economical, and useful.

Stress-strain behavior

The compressive load-deflection characteristics at 23° C. of rubber, vinyl, and urethane foam are shown in Figs. 4, 5, and 6, right. These curves were obtained with the device shown in Fig. 7, p. 142, which is similar to the compression-indentation apparatus used in the rubber foam industry[1] (1, 2). A 50-sq. in. indentor is forced into a 12- by 12- by 1-in. section of foam at a constant rate, and the amount of movement of the indentor measured as the "deflection." At 50% compression (deflection), the direction of movement of the indentor was reversed after a 60-sec. dwell, and the compression backed off at constant rate to zero, giving the descending portion of the curve. For a perfectly elastic material, the ascending and descending branches of the curve coincide. This is known as zero hysteresis. Note that the hysteresis (area of loop) is quite large for urethane, moderate for the vinyl, and small for the rubber.

The ascending part of the curve serves to give a clue to the cushioning effectiveness of the material. Both the rubber and the vinyl show a reasonably uniform relation between load and compression. These materials would provide similar cushioning, elastic action. The polyurethane, on the other hand, shows a rather sharp "yield point." It would feel hard and stiff until a compression of about 10% was reached but then would continue to give or compress with only a slight increase in load.

These curves illustrate the fallacy of using any single point measurement as a description of mechanical action of the material. In order to overcome this weakness, a so-called "yield index" has been used in an attempt to quantitatively describe this stress-strain behavior.

The "yield index" has been

[1]Numbers in parentheses link to references at end of article, p. 229.

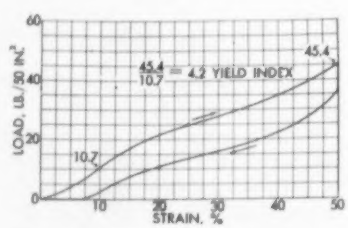

Fig. 5: Vinyl foam compression curve at 23° C.

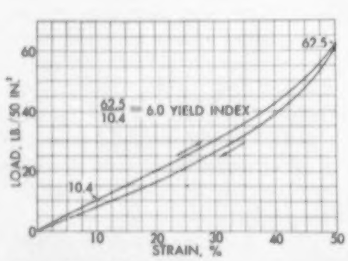

Fig. 4: Rubber foam compression curve at 23° C.

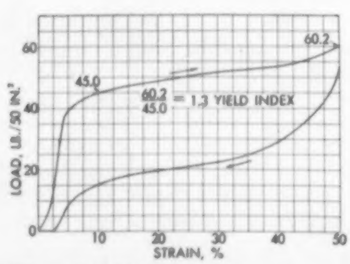

Fig. 6: Urethane foam compression curve at 23° C.

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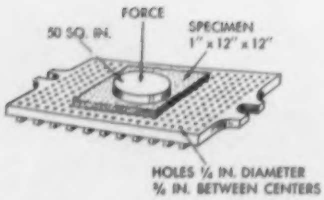


Fig. 7: Compression-deflection test set-up

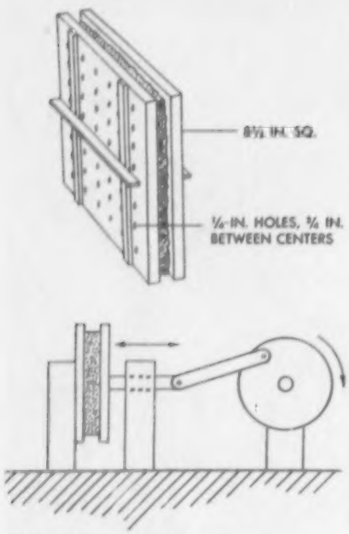


Fig. 8: Flexing test set-up

arbitrarily defined as the ratio of the loads at 50% and 10% deflection. A "yield index" figure between 4 and 6 is considered to be in the comfort zone. This is highly controversial, however, since the translation of such data to "human comfort" is strictly a psychological problem. The "yield indexes" for the various samples used are as follows:

Type foam	*Density*	*"Yield index"*
	lb./cu. ft.	
Rubber	6.9	6.0
Vinyl	6.0	4.5
Polyurethane	2.7	1.3

It can be said that the rubber is a bit too "bouncy," the vinyl about right, and polyurethane too "dead."

The imperfect elastic nature of plastics is often illustrated and measured by a "stress relaxation" type of experiment. In the foam business, this characteristic has been measured by plotting the decay of the compressive force when the sample is held at a constant deflection. Many different "standard" times have been suggested for this test, varying from 0.1 to 5 minutes. Most generally, it has been suggested that the compressive force should be measured 1 min. after the specified deflection is reached. An example of the effect of a 1-min. dwell time is shown in Figs. 4, 5, and 6 by the drop in load when held at 50% deflection. Rubber is least affected by dwell time. The compression data illustrated in these three figures are summarized in Table I, below. The compression-deflection value at 25% deflection and 23° C. is the standard method now in use in the rubber foam business to describe the "stiffness" of the material. Table I shows that at 23° C. and 25% deflection the rubber and vinyl have equal "compressibility" (25 lb./50 sq. in. or 0.5 p.s.i.), while the urethane is double this (50 lb./50 sq. in. or 1.0 p.s.i.). At 23° C. and 50% deflection with 1-min. dwell, the rubber and urethane are in the same range with vinyl being somewhat softer. At 60° C., the rubber and urethane are about the same as at 23° C. while the vinyl becomes softer. The hysteresis curve shows the urethane to be most susceptible to "energy" loss.

Fatigue testing

The A.S.T.M. specifications for latex foam rubber (D 1055-49T) contain a description of a "flexing test" (fatigue test). Specimens are repeatedly compressed 250,000 times at a rate of 60 cycles/min., and the breakdown in cell structure is measured by a change in thickness of the specimen. In order to perform this test on the samples described above, the attachment shown in Fig. 8, left, was made for a modified DeMattia fatigue machine. After 290,000 cycles of flexing (50% deflection) at 120 cycles/min., no appreciable change in thickness was detected for any of the materials tested.

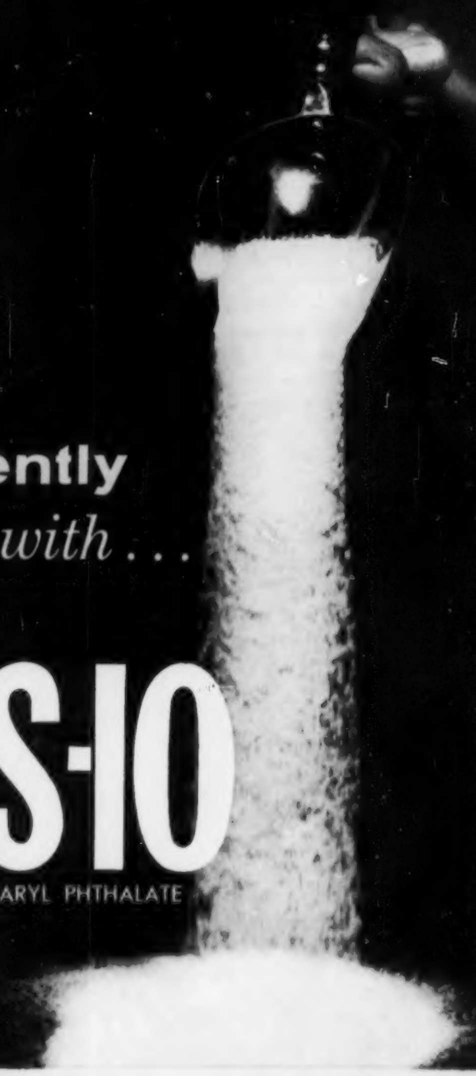
The breakdown of the material was measured, however, by obtaining compression-deflection data immediately after flexing and then after 6, 22, 144, and 600 hr. of rest. These "recovery" curves (25 and 50% deflection) are shown in Figs. 9 and 10, p. 144. Rubber is least affected by flexing, showing no appreciable change, urethane is most affected, and the vinyl is intermediate. The effect of flexing is not readily apparent to the eye, and the appearance is not greatly changed. The urethane, however, feels appreciably softer as the curves indicate. Also, the compression indentation curves show a pronounced change in the "yield point" of urethane and an accompanying change in hysteresis because of the flexing. The vinyl foam curves also change, but to a lesser degree. The rubber foam shows no appreciable difference.

Flammability

The A.S.T.M. specifications on foam rubber contain no references to flammability. The New York City Transit Authority and the Society of the Plastics Industry have been actively engaged, however, in testing plastic foam for flammability. Several tests have been made with the N.Y.C.T.A. flammability test (3), illustrated in Fig. 11, p. 144. The rubber foam ignites and burns with alacrity. Vinyl and urethane melt and drop into the flame. The time of ap-

Table I: Compression data for three foams

Foam	Compression-indentation 25% strain	50% strain	50% strain (60 sec. dwell)	Hysteresis 50% strain (60 sec. dwell)
	lb./50 sq. in.	lb./50 sq. in.	lb./50 sq. in.	in.-lb.
At 23°C.				
Rubber	24	60	59	1.7
Vinyl	25	47	39	4.8
Urethane	50	58	51	9.2
At 60°C.				
Rubber	27	55	54	1.0
Vinyl	14	23	20	2.0
Urethane	51	66	52	9.8



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Condition of Powder Mix	Dry, Free Flowing	Non-Free Flowing
Color	White	Light Tan
PROPERTIES OF PLASTIC		
Volatility @ 90°C.—Weight Loss %[1]	0.99	0.95
Water Extraction @ 85°C.—Weight Loss %[2]	1.9	5.6
Soapy Water Extraction—Weight Loss %[3]	2.2	4.4
Oil Extraction—Weight Loss %[4]	1.2	1.1
Migration into Lacquer	Nil	Nil

(1) ASTM-D1203-52T
(2) Method of E. F. Schulz
(3) Immersed 24 hours @ 60°C. in 1% Ivory Soap Solution
(4) Immersed 10 days in Atreol #9 @ 23°C.

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- Low rate of migration
- Greatly improves processing characteristics while maintaining the permanence of plasticizer systems in blends with polymeric plasticizers

Write for **FREE SAMPLES** *and* **TECHNICAL LITERATURE**

CABOT PLASTICS CHEMICALS DIVISION

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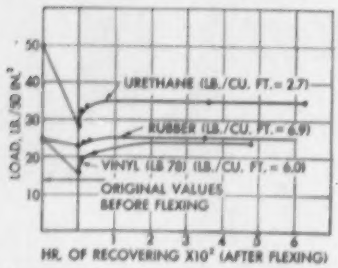

Fig. 9: Recovery of compression-deflection properties. The values shown are for 25% deflection

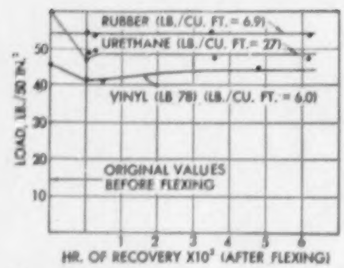

Fig. 10: Recovery of compression-deflection properties. The values shown are for 50% deflection

pearance of flame, smoke, or a hole in the upper surface of the specimen is the end point of the test. With urethane, the time was 20 sec. and with the vinyl 50 seconds. The interpretation of data from this test is very much open to question and could lead to considerable controversy.

Figure 12, right, illustrates the flammability test proposed by the S.P.I. Cellular Plastics Division. The flame is held under the test sample for 10 sec. and then removed. The time required for the flame to propagate itself and reach the upper end of the sample or until the flame is self-extinguished is the end-point of the test. The urethane was self-extinguishing when the flame was removed. The vinyls flamed for 10 sec. after flame removal and were then self-extinguishing. Rubber required 30 sec. to burn completely. Numberwise, this test fails to distinguish adequately between rubber and plastic since they either burned or did not burn. By this test, however, urethane has a very slight advantage over this particular vinyl sample. The S.P.I. test appears to be fairly simple and is probably as good a test as is warranted.

Compression set

A number of compression-set tests are being discussed. Most of these consist of compressing the sample 50%, holding at 70° C. for 22 hr., releasing the force at room temperature, and measuring the thickness after a period of recovery. This is standard procedure as followed in the rubber foam industry. Under this kind of testing, urethane and rubber show apparent advantages over vinyl. The compression-set is arbitrarily defined as the original minus the final thickness divided by the original thickness, converted to percent. A large number indicates a high degree of permanent deformation. Representative data obtained with this standard procedure are shown in the second column of Table II, p. 146.

If, however, recovery is allowed to take place at the temperature at which the compression was applied (70° C.), different data are obtained. This factor was investigated by holding several samples at 50% compression and 70° C. for 22 hr. and allowing recovery to take place for 1 hr. at 23° C., 1 hr. at 70° C., and 22 hr. at 70° C. The effects of allowing recovery to occur at the elevated temperature is evident from values tabulated in columns three and four in Table II.

These data show that the temperature at which the sample is allowed to recover is of considerable importance for all materials but particularly so for the vinyl. From the existing rubber specifications, an arbitrary figure of not greater than 20% set appears to be common practice. This may or may not be a reasonable number, but certainly the importance of recovery tests at elevated temperatures should be considered. Which recovery temperature is closest to the actual application can be a debatable question.

Fusion (tensile test)

A vital question in the foam business appears to be fusion or "cure." This factor will be vitally important in the quality of the finished product. Most of the discussions in the field and S.P.I. have been concerned with attempts to measure this quality by indirect methods. Recently, however, the question of fusion has been brought out into the open, and the problem vigorously attacked. The question of fusion arises naturally from the heat distribution developed in dielectric heating. Exploratory tests in this laboratory have shown that fusion may be measured by a chemical test (ethyl acetate) or a mechanical test (tension) or some combination of chemical and mechanical action.

Three samples of vinyl foam received for S.P.I. round robin testing were fabricated to three different degrees of fusion. A

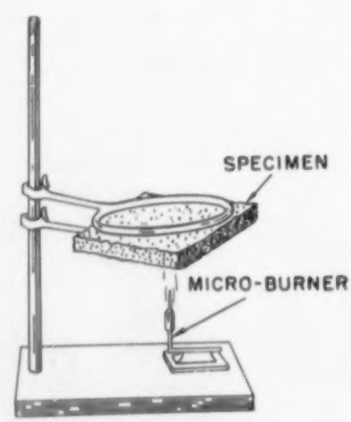

Fig. 11: Flame resistance test according to N.Y.C.T.S. Spec. No. 108-C-54

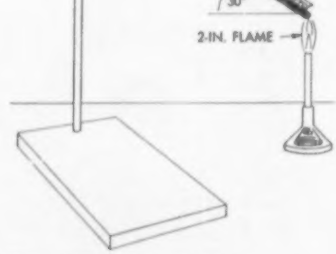

Fig. 12: Fire resistance strip test, as proposed by the S.P.I. Cellular Plastics Division

Outdoors two years—and PARAPLEX P-444 looks as good as ever

Two years ago, a test panel made of PARAPLEX P-444 polyester resin and glass fiber and a similar test panel based on a conventional polyester resin were placed on the roof of an isolated building. Today, after two years of continuous exposure, the panel based on PARAPLEX P-444 is still highly transparent and is not discolored. Fiber evidence, too, is as slight as in the original sample. The panel based on the conventional resin, on the other hand, has lost much of its transparency, and fibers and discoloration are quite evident.

PARAPLEX P-444 polyester-acrylic resin offers to manufacturers of corrugated panels, flat sheets, awnings and decorative sidings these advantages:

- excellent wetting of and adhesion to glass fibers
- refractive index of cured resin similar to that of glass
- unusual resistance of cured resin to erosion and discoloration
- controllable transparency

For more details on PARAPLEX P-444 and other Rohm & Haas polyester resins, write to Department WEW-1-6.

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Table II: Compression-set data for three foams*

Foam	*1 hr. at 23°C.*	*1 hr. at 70°C.*	*22 hr. at 70°C.*
	%	%	%
Rubber	2.9	1.8	1.6
Urethane	3.7	1.6	1.2
Vinyl	20.5	12.0	7.8

*Compression-set after 22 hr. at 70°C. (50% deflection) followed by recovery for times and temperature shown.

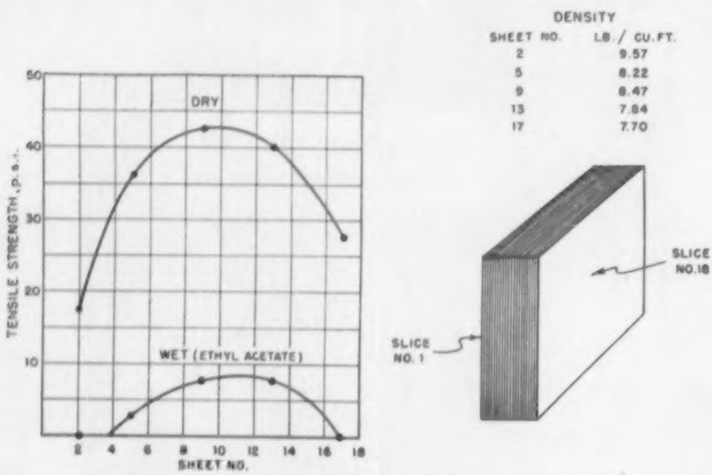

Fig. 13: Tensile strength of various sections of vinyl foam, tested both when dry and when wet with ethyl acetate

simple tensile test (dumbbell shaped specimens die cut from slices of foam) was very effective in separating the materials:

Material	*Degree of fusion*	*Tensile strength*
		p.s.i.
A	Poor	17.3
B	Moderate	22.7
C	High	31.7

It was also found that immersion of these specimens in ethyl acetate produced a pronounced decrease in strength as follows:

Material	*Tensile strength after immersion (in ethyl acetate)*
	p.s.i.
A	0.4
B	2.0
C	4.5

An investigation of the fusion problem was undertaken with samples prepared from a block of vinyl foam. This sample was prepared in order to show a gradient of fusion. A 24- by 24- by 2½-in. block of vinyl foam (specially prepared) was sliced into 18 thin sheets (approximately ⅛ in. thick). Tensile tests on these slices, in air and after immersion in ethyl acetate, show the surfaces of this sample of foam to be weak and poorly fused while the center is strong, and well fused. Figure 13, above, shows 1) the tensile strength in air, 2) tensile strength after a 15-sec. immersion in ethyl acetate, and 3) the density as a function of the location in the specimen. The superior tensile strength of the center portion is quite evident, and no correlation with density is indicated. The surface layers were easily torn and abraded in handling, which indicates the practical importance of this tensile property.

Fusion ("constant strain")

In trying to establish a simple ethyl acetate fusion test, the "constant strain" fusion test was developed. The preliminary results of this work look promising. The method used for these experiments was to strain a specimen a given amount, apply several drops of ethyl acetate to the center of the specimen, and record the time to failure (fracture). This procedure then was repeated on new specimens at various other strains. From this data, a curve was constructed by plotting strain *versus* time to failure. Figure 14, below, has four curves obtained in this manner from sections of the sliced vinyl foam, representing various stages of cure (fusion). Figure 15, below, has curves for other vinyl foam samples A, B, and C also representing various stages of cure. In all cases, the test was very effective in separating the materials.

In using this test procedure, one end of the specimen (¼- by ½- by 6-in.) was tacked on a board and, using a 5-in. gage length, the other end was drawn to give the desired strain and also tacked. Several drops of ethyl acetate were then applied to the center of the specimen and, at the same time, a timer was started. The timer was stopped at the time of failure (fracture) or, at the end of 300 sec., the test was discontinued.

The curves all level off at approximately 10 sec. making a good point for comparison. The

(*To page 226*)

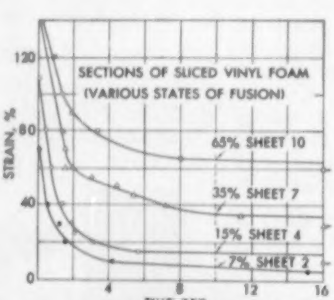

Fig. 14: Strain *vs.* time to failure; 4 specimens, with spot of ethyl acetate

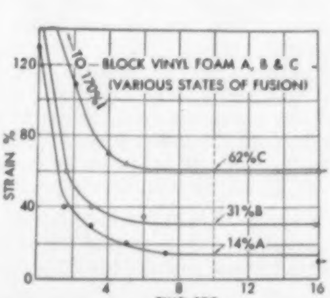

Fig. 15: Strain *vs.* time to failure; 3 samples, with spot of ethyl acetate

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Having the broadest selection of plastics available at one convenient source simplifies the problem of selecting the right material for your purpose. Bakelite Company offers the greatest variety of the most widely-used plastics, and provides the assistance of qualified technical representatives to guide you in their application. Extensive research and development facilities, together with strategically located plants and warehouses, complete the combination that can materially aid in producing a successful product.

(continued on next page)

PHENOLICS • STYRENES • IMPACT STYRENES

POLYETHYLENES • VINYLS • POLYESTERS • EPOXIES

Deck and hull of this five-foot skiff are vacuum-formed from extruded sheets of BAKELITE Impact Styrene TGD-5001. Details are on next page.

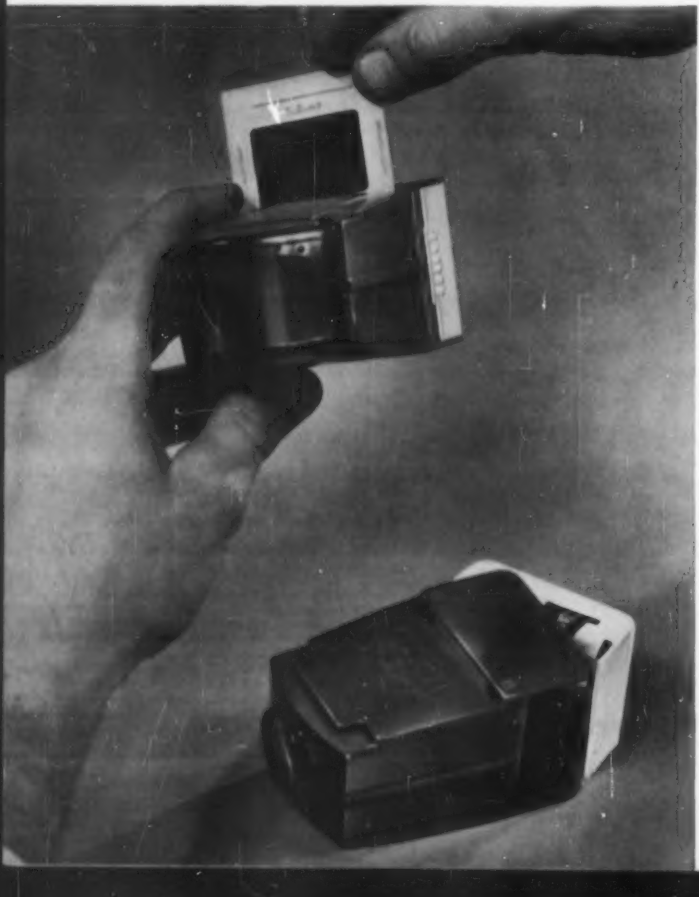
Makes Selection Simpler

(continued from preceding page)

"Pirateer" skiff made by **Plastiform Co.**, Ypsilanti, Mich.

Children go sailing on extruded impact styrene sheets

The deck is painted red, the hull white, and both have a sleek planking effect . . . all in all, a skiff to gladden the heart of any youngster. Made of BAKELITE Brand Impact Styrene TGD-5001, its sections are extruded sheets, vacuum-formed and bonded together for water-tightness. The skiff measures 5 feet long, 19 inches wide, and 8 inches deep, and it displaces 200 pounds, according to the manufacturer. Yet its light weight—10 pounds—means that a child can handle it alone. Upkeep from season to season is no problem since there are no parts to rot, rust, or mildew. BAKELITE Impact Styrene TGD-5001 is especially formulated to resist shock, corrosion, and continued exposure to water.



Impact Styrene selected for molded slide viewers

Both of these slide viewers are molded from the same tough, glossy, richly-colored material—BAKELITE Brand Impact Styrene TMD-5151. One model permits viewing with both eyes at normal reading distance; the other is held up to one eye. When a slide is inserted, a spring contact automatically turns on the light. Batteries and bulb are readily accessible, since each viewer is equipped with a molded latch that permits the base to swing open under finger pressure, without need for a screwdriver or coin.

The viewers are good examples of the molded detail and good finish obtained with TMD-5151. Economy is another feature—the viewers are popularly priced.

Slide viewers produced by **J. & M. Zadiix Products Co.**, Brooklyn 15, N.Y.

Soap dispenser—another important part for automatic washers

This soap dispenser, molded from Bakelite Brand Phenolic BMG-5316 Black 25, is one of the growing number of phenolic parts that have to meet the grueling service demands of automatic washers. In this application, BMG-5316 was selected for its resistance to chemicals, moisture, and impact. It is particularly useful where mild alkaline or acid solutions are encountered. Another factor was its moldability, permitting plunger molding in a multicavity mold. Since this phenolic is a two-step material, it provides greater molding latitude and better mold release than one-step compounds.

Soap dispenser molded by **Mack Molding Co.**, Wayne, N. J.

"Carpetmates" furniture supports made by **Childlore Company**, Kansas City 8, Mo.

C-11 Plastic supports furniture, saves carpet

These furniture disks molded of Bakelite Brand C-11 Plastic are constructed to support any furniture load, even a 1500-pound grand piano, without marking the carpet piling. This is due to their unusual design, which incorporates more than 100 tapered shafts in the one-piece molding. The strength and durability of the disks have been determined by laboratory testing—they demonstrated high flexural strength, and low percent of creep under load. They have been tested on all types of carpet piling, with no marking of the piling or penetration of the backing.

C-11 Plastic possesses excellent toughness and flexural strength. Its good moldability is evident from the detail of these pieces. And for this application, its color range permits the disks to be offered in straw clear, gray, and walnut brown to blend with either furniture or carpet.

One plastics source...

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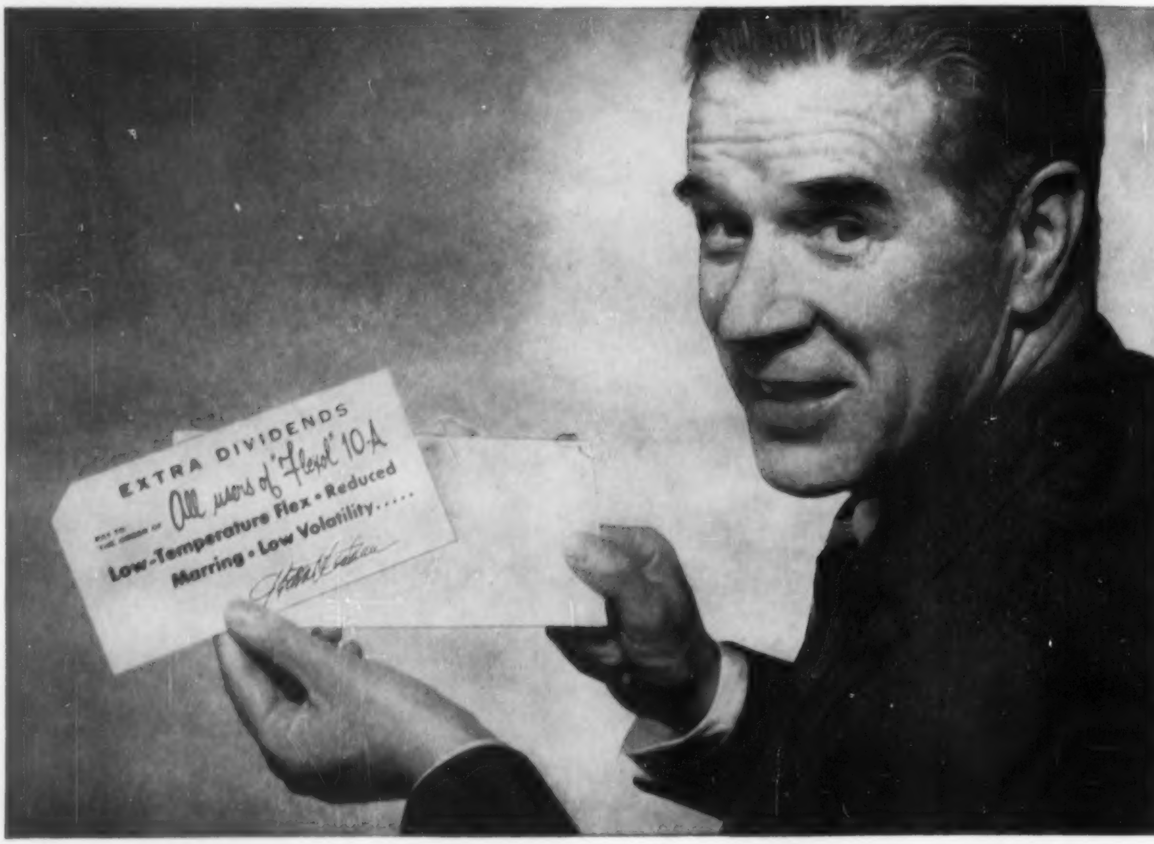

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FLEXOL Plasticizer 10-A is widely useful in the vinyl plastics industry in calendered film and sheeting, electrical insulation compounds, profile extrusions, slush moldings, and dip coatings. It is a good plasticizer for nitrocellulose and a softener for natural or synthetic rubber.

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Polyamide-11 in the electrical field

*By R. Dumon**

Polyamide-11 has, in addition to the unequalled mechanical properties common to all polyamides, certain special characteristics which make it particularly useful for electrical construction and apparatus. Its low water absorption, for example, makes it an excellent insulator in the range of low and medium frequencies and low and medium voltages. Therefore, it supplements polyethylene and polystyrene and finds its use in certain well defined fields of application (molding, extrusion, coatings) where high mechanical resistance, complete inertness to chemical and atmospheric agents, and a wide range of use temperatures are sought, together with good electrical properties.

A new French plastic belonging to the class of the polyamides, Rilsan, has qualities that have rapidly found it numerous applications in the electrical industry. While most polyamides absorb a certain amount of water (up to 10%), this new material has a very low moisture vapor absorption (of the order of 1%), giving it excellent, constant insulating properties, regardless of the surrounding conditions.

The raw material for Rilsan is produced from the castor-oil plant which is now raised in abundance in the French Union, South America, South Africa, and India. Castor oil contains 90% ricinoleic acid esters. A series of chemical treatments and thermal cracking leads to a chemically pure compound, 11-amino-undecanoic acid, which upon polymerization results in a polyamide having the following chemical formula:

$$H\,[NH(CH_2)_{10}CO]_nOH$$

The basic properties of this polyamide-11 are similar to those of the other polyamides such as nylon-6/6 which was, for a long time, the only polyamide being produced. However, it possesses some characteristic properties that distinguish it from other polyamides. Thus, having a longer molecular chain, it has physical properties that are intermediate between those of the other polyamides of shorter chain length and of polyethylene.

Physical properties

The specific gravity of polyamide-11 is low (1.04) and lies between that of nylon-6/6 (1.14) and that of polyethylene (0.94). The melting point is 356° F. The maximum temperature at which it can be used continuously in air is 212° F., but it tolerates prolonged overheating to 284° F. very well. In the region of low temperatures, it may be used to −67° F. The range of temperature for continuous utilization is therefore particularly wide: −67° F. to 212° F.

Polyamide-11 has a high specific heat (0.58) which, since it is a good insulator, allows it to resist local overheating by absorbing a large number of calories. Like all polyamides, it is "self-extinguishing."

Its chief distinction from the other plastic materials of its group and particularly from nylon-6/6 is its very low water absorption. In his well known book, "Die Polyamide," Dr. Hopff gives the data shown in Table I for maximum water absorption by various polyamides.

This low water absorption is the reason why variations in relative humidity have little in-

Table I: Water absorption by polyamides

Polyamide (tradename)	*Weight increase* — *Immersion in water at room temperature* — *14 days*	*maximum value*	*Immersion for 3 hr. in boiling water*
	%	%	%
Ultramide A	10.0	10.0	8.5
Ultramide B	6.8	10.9	3.3
Ultramide B special	9.3	9.8	7.6
Ultramide 6A	12.2	14.0	16.3
Nylon-6/6 or nylon FM-10001	10.2	10.2	8.6
Nylon FM-3001	3.2	3.2	3.7
Nylon FM-6401	9.6	10.7	Destroyed
Akulon M 2	10.6	11.6	8.3
Rilsan	1.6	1.6	2.0
Polyurethane U	2.1	2.2	2.4
Nylon AF	8.6	8.9	7.3
Grilon	10.0	11.2	6.8

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*Plastics engineer, Organico, S.A. (Paris)

fluence on the dimensional stability and especially on the insulating properties of parts made from polyamide-11. It remains a good insulator in a saturated atmosphere or in water.

Thus, polyamide-11 may be used as the sole primary insulator on a large number of electrical wires, parts made from polyamide-11 or coated with it maintain their electrical characteristics when they are submerged in water; adhesive insulating tapes made from polyamide-11 may be used anywhere.

Rilsan is an excellent insulator in the range of low and medium frequencies; its electrical characteristics are described below.

Volume conductivity

Plastic materials such as the polyamides are not perfect insulators; when subjected to a continuous high potential, they permit passage of a very low, but still appreciable current.

The insulation resistance between two electrodes separated by a solid insulator is defined as the ratio between the potential applied to the electrodes and the current that flows from one to the other. But the existing current is a combination of several different currents: one which charges the condenser thus formed and which will be restored upon discharge; another which flows from one armature to the other through the thickness of the dielectric itself and which will not be restored upon discharge and which corresponds well to the volumetric conductivity; and finally a third which flows along the lateral surface of the insulator and corresponds to the surface conductivity.

Under a continuous potential difference of 1000 v. at a temperature of 64° F. for 4 days, in an enclosure having a relative humidity of 80%, the following value for volume resistivity is obtained with a plate of standard Rilsan BM of a thickness of ⅛ in.: 3×10^{14} ohms/cm.

As is the case for the other thermoplastic materials, the insulation varies very rapidly, inversely to the temperature, and the curve for the phenomenon is exponential. An almost straight line is obtained (Fig. 1) when the reciprocal of the temperature is plotted on the abscissa and the logarithm of the resistivity on the ordinate. At 60° C. (140° F.) the resistivity is 1×10^{10} ohms/cm.

The resistivity of insulators, and particularly that of the polyamides, is sensitive to humidity. However, owing to its resistance to humidity, polyamide-11 maintains good electrical insulating resistance even when submerged in water.

The following values are obtained at 18° C. (64° F.): after 24 hr. in a drying oven, 6×10^{14}; after 4 days at 80% relative humidity, 3×10^{14}; after 24 hr. in water, 1×10^{13} ohms/cm.

Arc resistance

Numerous experiments have been carried out by causing a spark to flash between two tungsten points 0.4 in. apart on the same side of the plate; the points are at an angle of 45 degrees to each other and are inclined at an angle of 45 degrees with respect to the plate. The effective value of the intensity was approximately 4 ma., that of the potential difference at the terminals 5 kv.; the time which elapses between the start of lighting the spark and the production of a conducting path in the surface layer of the plate, leading to extinction of the spark, is measured. For Rilsan this time is approximately 16 sec., which places this polyamide among the best thermoplastic materials from this point of view.

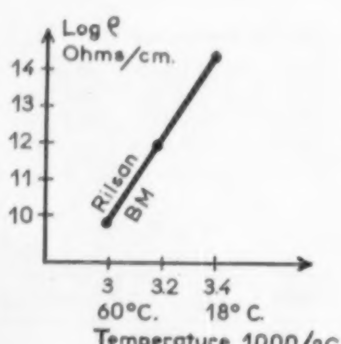


Fig. 1: Insulation as a function of temperature

This arc resistance depends very much upon the surrounding humidity and, in an atmosphere of very high humidity, the majority of substances is covered with a film of absorbed water which causes a decrease of arc resistance. The measurement is carried out at a temperature of 18° C. (64° F.) with a relative humidity of 80 percent.

Dielectric strength

An insulating plate is not capable of resisting an indefinitely increasing potential; when the applied potential reaches too high a value, perforation or failure of the insulator occurs. When progressively increasing the effective value of the alternating current applied to two brass disks located on either side of a plate of a thickness of 0.12 in., a perforation potential of 51,000 v. is obtained at 18° C. for a dry plate of Rilsan BM; the dielectric strength is, therefore, 425 v./mil.

This dielectric strength or break-through potential is essentially proportional to the distance between the disks only for a gas or a liquid; owing to local heating, the dielectric strength of a solid will depend upon its thickness. The following values were obtained for various thicknesses of Rilsan:

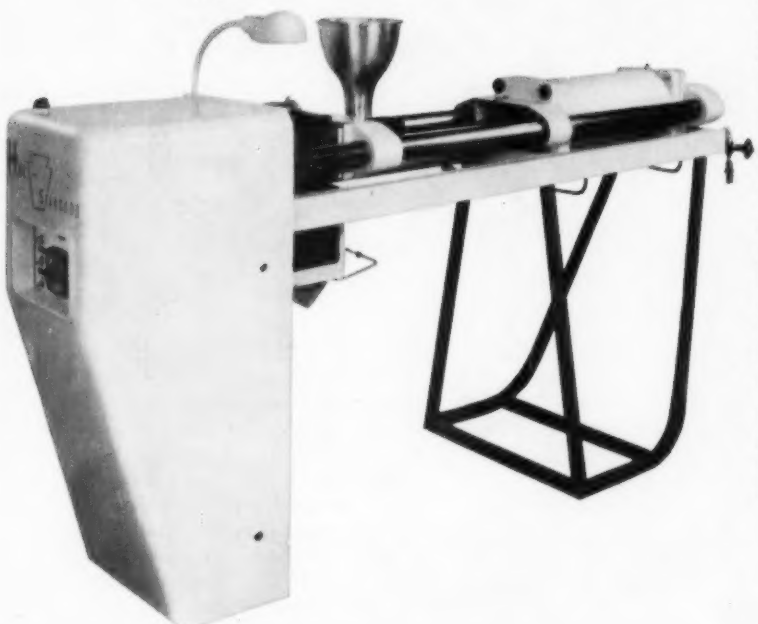
Thickness	*Dielectric strength*
in.	*v./mil*
0.120	425
0.020	1000
0.008	1450
0.004	1600

The dielectric strength also depends upon the temperature and for polyamide-11, as for the majority of thermoplastics, it decreases as the temperature increases. Measurements which were made on disks 4 mils thick resulted in the following values: at 64° F. 1600 v./mil; at 140° F. 900 v./mil.

Finally, this dielectric strength is unfavorably influenced by the humidity of the insulator; this influence is, however, relatively low for Rilsan, as indicated by the following measurements made on disks 0.02 in. thick: at 64° F.

New

Model 99-A fully automatic TRANSFER Molding Press for thermosetting plastics



Here is a *completely automatic transfer* molding press for thermosetting plastics, now available after eight years of design development and proven production performance.

The Model 99-A uses general purpose powder which does not require preheating. Designed to minimize mold costs . . . uses standard mold blocks held in position by a standard mold retainer set. Thus, low-quantity production runs become fully feasible. Compact press is especially suited to economical molding of small parts required by the trend toward miniaturization in electric and electronic components.

The Model 99-A is the latest addition to the well-known dependable STANDARD toggle-type presses, automatic, semi-automatic, and manual, which have served the molding industry for over 20 years.

Write for full specifications.

Why an automatic TRANSFER press?

Although many small parts can be made on compression presses, certain basic advantages are available in transfer molded parts.

- **Closer tolerance is possible (to $\pm 0.001''$, occasionally to $\pm 0.0005''$).**
- **More fragile part sections are possible.**
- **Flash is minimized—finishing costs are low.**
- **Finished holes are possible, since core pins can be piloted through to other half of mold.**

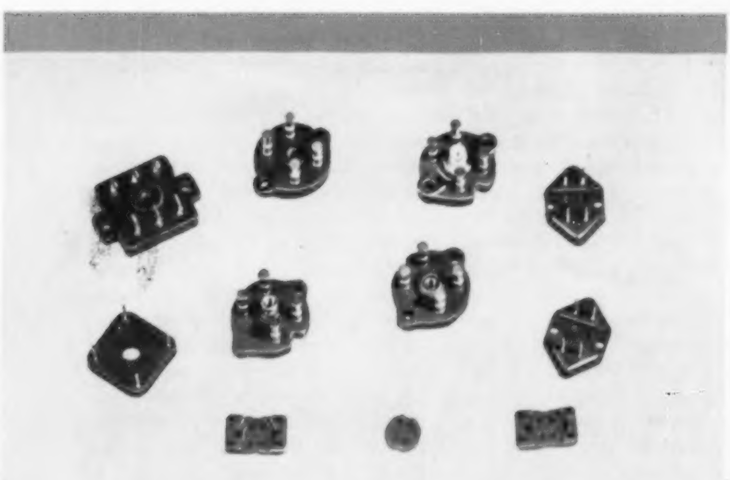


Illustration shows a few of the many parts which have been produced economically on the new press. The Model 99-A enables automatic molding of *through* holes for later addition of inserts—a method which leads to less expensive production of small finished parts than by molding with inserts in conventional semi-automatic techniques. (Parts shown are ⅔ actual size.)

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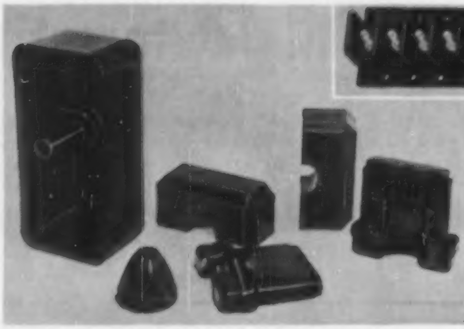
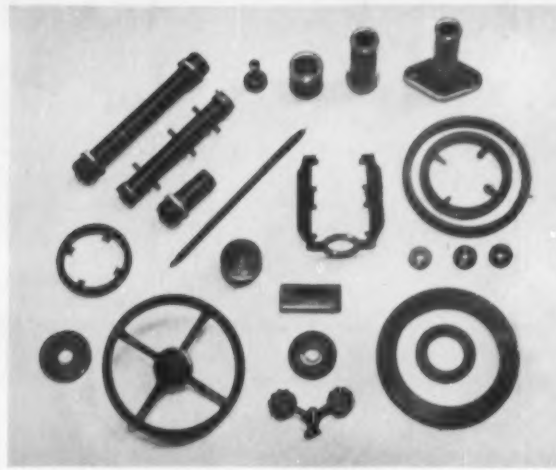


Fig. 2: Various radio components injection molded of polyamide-11 material



after 24 hr. of drying, 1000 v./mil.; at 64° F. after 24 hr. in water, 615 v. /mil.

Loss angle

Measured on the Schering bridge with 1000 effective v. and a 1000-cycle current, Rilsan gives tan δ = 0.03. Humidity and temperature always have an unfavorable influence on the loss angle. Although polyamide-11 shows little avidity for water, the following results were obtained at 1000 cycles: after 24 hr. of drying, tan δ = 0.03; after 48 hr. of immersion in water, tan δ = 0.045.

Finally, high temperatures cause a distinct increase of tan δ which, from 64 to 140° F., goes from 0.03 to 0.07 for 1000 cycles.

Mechanical properties

The superpolyamides are characterized by mechanical properties that make them especially suitable for certain applications. Toughness, elongation, and resistance to compression and flexure are high. In the stretched state, which results in a molecular orientation in the direction of stretching, the fibers and the filaments attain a toughness of the order of 74,000 p.s.i. But even in the unstretched state, that of the molded plastic material or of the electrical cable covering, polyamide-11 has a toughness of 9000 to 10,000 p.s.i., a maximum elongation of 60 to 250%, and a resistance to compression of 12,000 to 16,000 p.s.i. Even at low temperatures, the impact resistance is still good.

Good resistance to abrasion is a distinctive characteristic of polyamides as well. The coefficient of friction is very low (of the order of 0.11 to 0.18 on steel while dry); the surface is hard and highly polished.

The various grades of Rilsan differ in hardness and flexibility: BC is hard, BC P20 semi-flexible, and BC P40 flexible. BC has the highest resistance to abrasion; BC P40 has the best resistance to shock and flexure.

Chemical properties

All pure polyamides have good resistance to alkalies, oils, and petroleum products. However, while certain polyamides are soluble in mixtures based on alcohols (methanol), formalin, or phenol, Rilsan has low chemical affinity and is, therefore, difficult to dissolve. Cresol is its only solvent. Polyamides offer good resistance to organic acids, to fatty acids, to hydrocarbons, and to numerous dilute oxidizing agents; only concentrated mineral acids destroy them by rupture of the molecular chain.

Molded parts

Polyamide-11 can be injection molded on all modern presses according to the well known methods for molding polyamides. As the melting point of polyamide-11 is 186° C. and its decomposition point 265° C., the molder may select the injection temperature between these two values according to the desired viscosity of the material.

Hard Rilsan BM is used for the manufacture of parts for electrical insulation. Owing to its high fluidity at high temperatures (240 to 250° C.), polyamide-11 permits the selection of the most complicated shapes of molds and the production of very low wall thickness (0.016 in.). It also permits all types of metallic inserts.

In the field of radio, terminal supports, insulating prongs, screws, nuts, and self-locking insulating bolts (Fig. 2, above) have been molded from Rilsan. In the field of telephone communications, jacks and frameworks for coils (Fig. 3) have been molded. In the field of electricity for the household, switch buttons, disks, and insulating housings made from polyamide-11 resist overheating and, for most normal applications, are practically unbreakable.

For the automobile, wind shields and blinkers, heads for coils, push buttons, contacts, and even tight monoblock coils have been molded.

In aviation and shipbuilding, all kinds of electric wall plugs, which are treated to impart re-

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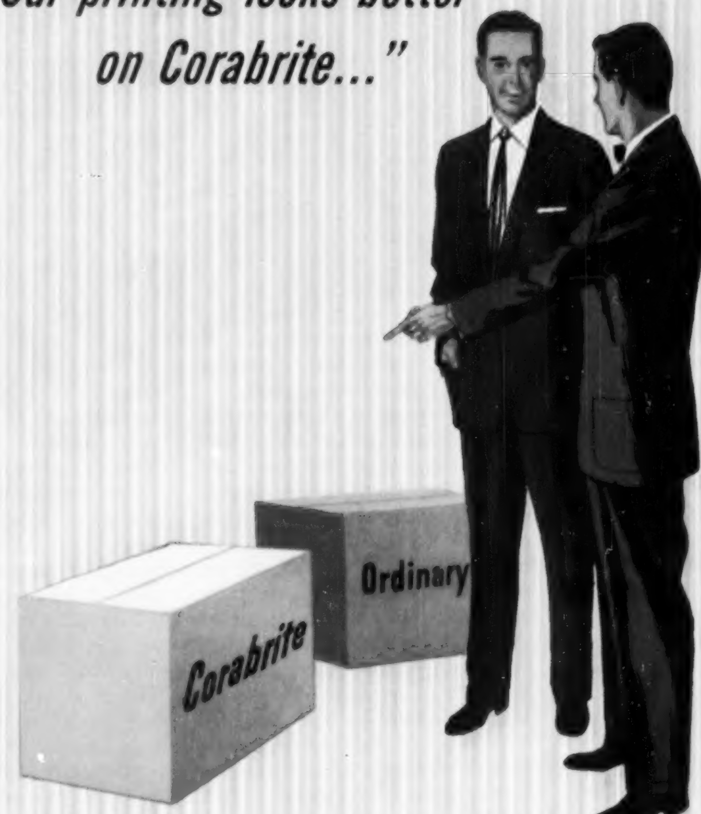

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sistance to tropical conditions, as well as insulating apparatus have been molded.

Wire insulation

Owing to the fact that its melting range is fairly wide for a polyamide (of the order of 15° C. for grade BC), Rilsan can be extruded on all existing equipment, provided some precise conditions are maintained (drying the powder; measured, regular feed; rather long screw of low thread depth; grating to divide the pressure; filters of 60/100 mesh; rapid cooling in water).

Flexible Rilsan (grades BC, P40, or TM) has been used as sheath for mechanical protection (or as secondary insulator). It is used over polyethylene for military telegraphy, for wires or cables for high frequencies or high tension, and for radio or television cables; over polyvinyl chloride or rubber for exterior or interior telephone installations; and over fibrous glass for certain nonflammable cables (aviation).

Hard Rilsan (grade BM), owing to its excellent electrical properties in the range of low and medium frequencies and of low and medium tensions, is also used as the sole or primary insulator (Fig. 4) for windings in motors and solenoids (2 mils thick), for aviation equipment (8 mils thick), for land equipment, and for aerial branch lines (3 mils thick).

The following data were obtained for a copper wire of a diameter of 20 mils insulated with a layer of polyamide-11 of a thickness of about 4 mils. Maintained under a potential, the insulation resists 25,000 v. for 15 min. at 15° C. as well as at 60° C. The perforation potential at 15° C. is 6400 v., at 60° C. 3600 volts. The insulation resistance at 15° C. is 160 megohms/kilometer.

In many cases, polyamide-11 can be applied in very thin layers (4 to 8 mils), owing to its good dielectric strength and mechanical properties. These thin layers can always be produced and are equivalent to much thicker layers of other plastics. For equal electric properties, the weight of the wire and of its coating is much lower.

Rilsan owes its success in cable manufacture particularly to its resistance to wear, shock, and crushing. On the other hand, if the single wire loses its coating easily, polyamide-11 adheres strongly to multifilament strands of small diameter. During soldering polyamide-11, like the other polyamides, melts upon contact with the soldering iron and thus eliminates itself; soldering can, therefore, be carried out without preparing the ends of the wire and affects only a short piece of the insulator. Cable manufacture thus becomes very rapid and economical, especially when the lengths of cable used are small.

Wires and cables insulated with flexible Rilsan P40 are used in refrigeration equipment. This special grade withstands a temperature of −70° C., i.e., a temperature even lower than does the standard grade. As polyamide-11 is also resistant to solvents, gases, and liquids used in refrigeration, it is an ideal insulator for everything in this very special industry.

For shipbuilding and aviation, the standard grade has undergone the special aging tests required by the French Aéronautique, i.e., seven temperature cycles of 12 hr. at 212° F. and 12 hr. at 140° F. The load at break, which was originally 5930 p.s.i., went to 6313 p.s.i. after aging; the elongation at rupture went from 175 to 152%; the change was thus low. The dielectric strength remained excellent after aging.

For aviation, polyamide-11 has been chiefly used over fibrous glass winding. The brittleness of the glass fiber, which is resistant to heat and combustion, is counteracted by an external coating of polyamide-11 which gives the assembly its mechanical properties (resistance to abrasion, to flexure, and to torsion).

For military transmission lines, the stability to weather of cable insulated with polyamide-11 is generally appreciated, together with its mechanical properties.

Plasticizer migration is no problem, as Rilsan does not contain any usual plasticizer. Light, as well as other atmospheric agents, has no effect on properly prepared Rilsan.

Black Rilsan P20 has been used in North Africa for aerial branch cables. Cables that have been exposed to the rigorous conditions of that country for several

(To page 230)

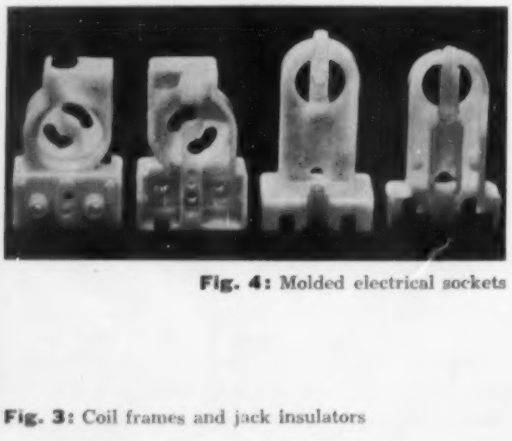

Fig. 4: Molded electrical sockets

Fig. 3: Coil frames and jack insulators

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Thermal properties of laminates

By F. R. O'Brien,[*] Sabert Oglesby, Jr.,[*] and P. C. Covington[*]

Recent developments in the use of plastic laminates have increased the need for additional information regarding the behavior of these materials over the range of temperature to which they may be exposed. Particularly lacking from the literature is information regarding the thermal properties of these materials.

In order to determine the influence of temperature on the thermal characteristics of these materials, a series of measurements of the thermal properties of a selected group of fibrous glass-reinforced plastics was made under the sponsorship of the Materials Laboratory, Wright Air Development Center. These measurements included specific heat, thermal conductivity, and thermal expansion of the selected laminates.

[*]Southern Research Institute, Birmingham, Ala.

Specific heat

The particular laminates selected included four different types of resin and six different types of fibrous glass fabrics and mats.

Several plastic laminates with changes in the various laminating variables, such as resin content, thickness, and percentage of voids, were also added to this group. Data identifying the types of resins and reinforcing materials for the laminates tested in this study are given in Tables I and II, p. 160.

Specific heat determinations for this group of laminates were made with a dry-type adiabatic calorimeter as shown in Fig. 1, p. 160.

This test apparatus, which is more or less conventional, is similar to that used by other investigators in this field. In this particular apparatus the brass calorimeter cup is approximately 2½ in. outside diameter by 1½ in. inside dia. by 3 in. long. The guard cup is supported in a water bath by a Transite ring. The bath is heated by a bare, Nichrome-wire heater. The sizes of the bath and the bath heater were selected to give a response rapid enough to

Table I: Composition of laminates

Laminate code no.	*Fabric no.*	*Finish*	*Resin*	*Resin code no.*	*Resin content*	*Resin viscosity at 77° F.*	*No. of plies*	*Laminator*
					%	cp.		
GY-B	128	Volan A	Selectron	5003	39.2	850	18	Goodyear
GY-C	181	Volan A	Selectron	5003	40.8	850	12	Goodyear
GY-D	143	Garan	Selectron	5003	43.5	850	11	Goodyear
GY-A	116	Garan	Selectron	5003	39.5	850	30-32	Goodyear
GY-E	181	Volan A	Selectron	5003	29.2	850	11	Goodyear
GY-F	181	Volan A	Selectron	5003	37.5	850	11-12	Goodyear
GY-G	181	Volan A	Selectron	5003	42.8	850	12	Goodyear
CTL-A	181	Volan A	Phenolic	CTL-91-LD	28.3	—	14	Cincinnati Testing and Research Lab.
S	181	—	Epon/Plyophen 33/67	1001/5023	24.5	—		Shell
DC	181	OC 112	Silicone	2104	32-35	—	14	Dow Corning
AC	181	OC 136	Laminac[c]	PDL 7-669	33.9	4500	12	American Cyanamid
CTL-B	[a]	—	Phenolic	CTL-91-LD	44.2	—		Cincinnati Testing and Research Lab.
CTL-C	[b]	—	Phenolic	CTL-91-LD	42.2	—		Cincinnati Testing and Research Lab.
GY-I	181	Volan A	Selectron	5003	34.1	850	11	Goodyear
GY-H	181	Volan A	Selectron	5003	24.5	850	4	Goodyear

[a]Owens Corning—¾ oz. phenolic resin mat.
[b]Modigliani 1 oz. PFM.
[c]Catalyst: 1% Luperco ATC.

Table II: Laminating conditions and properties[a] of laminates

Laminate code no.	Thickness	Cure cycle Time	Cure cycle Temp.	Cure cycle Pressure	Post cure cycle Time	Post cure cycle Temp.	Specific gravity		Ultimate tensile strength	Tensile modulus of elasticity	Ultimate compressive strength	Flexural strength at 73°F.	Ultimate flexural strength at 500°F.	Flexural modulus of Elasticity at 73°F.	Barcol hardness
	in.	hr.	°F.	p.s.i.	hr.	°F.	Value	Sheet[b]	p.s.i.	10^6 p.s.i.	p.s.i.	p.s.i.	p.s.i.	10^6 p.s.i.	
GY-B	0.115	1½	160-180	—	2	220	1.848	1	—	—	—	54,190	—	—	69
GY-C	0.123	1½	160-180	—	2	220	1.828	4	—	—	—	59,540	—	—	66
GY-D	0.136	1½	160-180	—	2	220	1.716	6	—	—	—	90,650	—	—	58
GY-A	0.127	1½	160-180	—	2	220	1.765	3	—	—	—	56,800	—	—	65
GY-E	0.109	1½	160-180	—	2	220	1.919	1	—	—	—	66,450	—	—	66
GY-F	0.116	1½	160-180	—	2	220	1.835	6	—	—	—	70,960	—	—	64
GY-G	0.135	1½	160-180	—	2	220	1.819	6	—	—	—	57,680	—	—	64
CTL-A	0.120	½	250	160	108	250-350	1.91	Av.	46,500	4.42	48,500	72,500	54,100	3.9	77
S	0.114	½	310	25	108	250-350	1.74	Av.	41,000	—	55,100	73,900	43,200	3.6	55
DC	0.141	½	347	30	18	194	1.619	Av.	19,150	1.62	12,300	23,216	10,558	2.26	37
AC	0.118	½	220	30	3	500	1.865	Av.	27,500	2.89	22,900	47,700	33,200	3.35	70
CTL-B	0.130	½	250	200	108	250-350	1.51	Av.	13,620	2.21	12,580	22,720	20,740	1.38	56
CTL-C	0.121	½	250	200	60	250-300	1.64	Av.	13,640	2.71	41,640	24,840	20,640	2.13	66
GY-I	0.127	1½	220	—	2	200	1.621	2	—	—	—	—	—	—	—
GY-H	0.036	1½	220	—	2	200	1.907	6	—	—	—	—	—	—	—

[a]All physical tests conducted according to Federal Specification L-P-406b by manufacturers.
[b]Sheet number for specific gravity; Av. = average of all sheets.

follow the temperature changes of the calorimeter and, on the other hand, to have sufficient thermal capacity to make possible smooth control of the guard temperature.

The calorimeter was calibrated with an electrolytic copper specimen of known specific heat. The specimen used in calibration was approximately 1 by 1 by ¼ in. with a weight of 37.72 grams. In calibrating, the specimen was heated to a temperature of 320° F. in the oven and dropped into the calorimeter cup. Ten calibrating runs with the copper specimen gave an average calorimeter constant of 0.2691 B.t.u. per degree rise of the calorimeter cup. The maximum deviation that was observed from the average was 2.8 percent.

The specimens used in determining the specific heats of the laminates consisted of four 1- by 1-in. thicknesses (⅛ in.) of each sheet fastened together with pins cut from the same sheet. The four thicknesses gave additional weight to the specimens and permitted greater accuracy in measuring the specific heat.

In determining the specific heat with dry-type adiabatic calorimeters several procedures may be used. From many standpoints a method based upon the determination of the enthalpy of the specimen as a function of its initial temperature appeared to be the most satisfactory for computing the specific heat of this type of material over a wide temperature range.

The total change in heat content of the specimens can, of course, be determined from a knowledge of the calorimeter constant and the change in calorimeter cup temperature. However, unless relatively elaborate control is maintained, the final temperature of the calorimeter cup will vary somewhat with changes in the initial temperature of the specimen, and the heat content values obtained will be referred to different base temperatures. This effect is minimized in this particular apparatus since the mass of the calorimeter cup, and consequently its heat capacity, is large in comparison with that of the laminate specimens. However, the differences are still significant and a correction in the measured heat content values was made by determining the average change in heat content per degree and applying this as a correction to the measured heat content values to bring the measured heat content to a common reference temperature. In these measurements a temperature of 85° F. was used since the final calorimeter cup temperatures averaged about this temperature. The enthalpy above the selected reference was computed as:

$$\Delta h_{85°F.} = \frac{K(t_1 - t_2)}{W_s}\left[1 + \frac{(85 - t_1)}{(t_2 - t_1)}\right]$$

where Δh is the enthalpy per unit

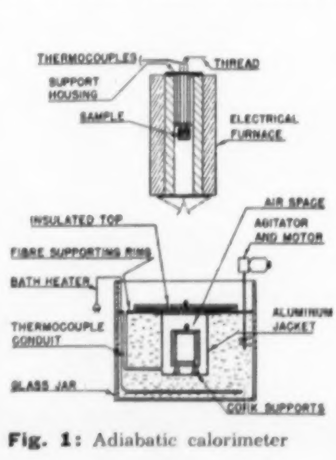
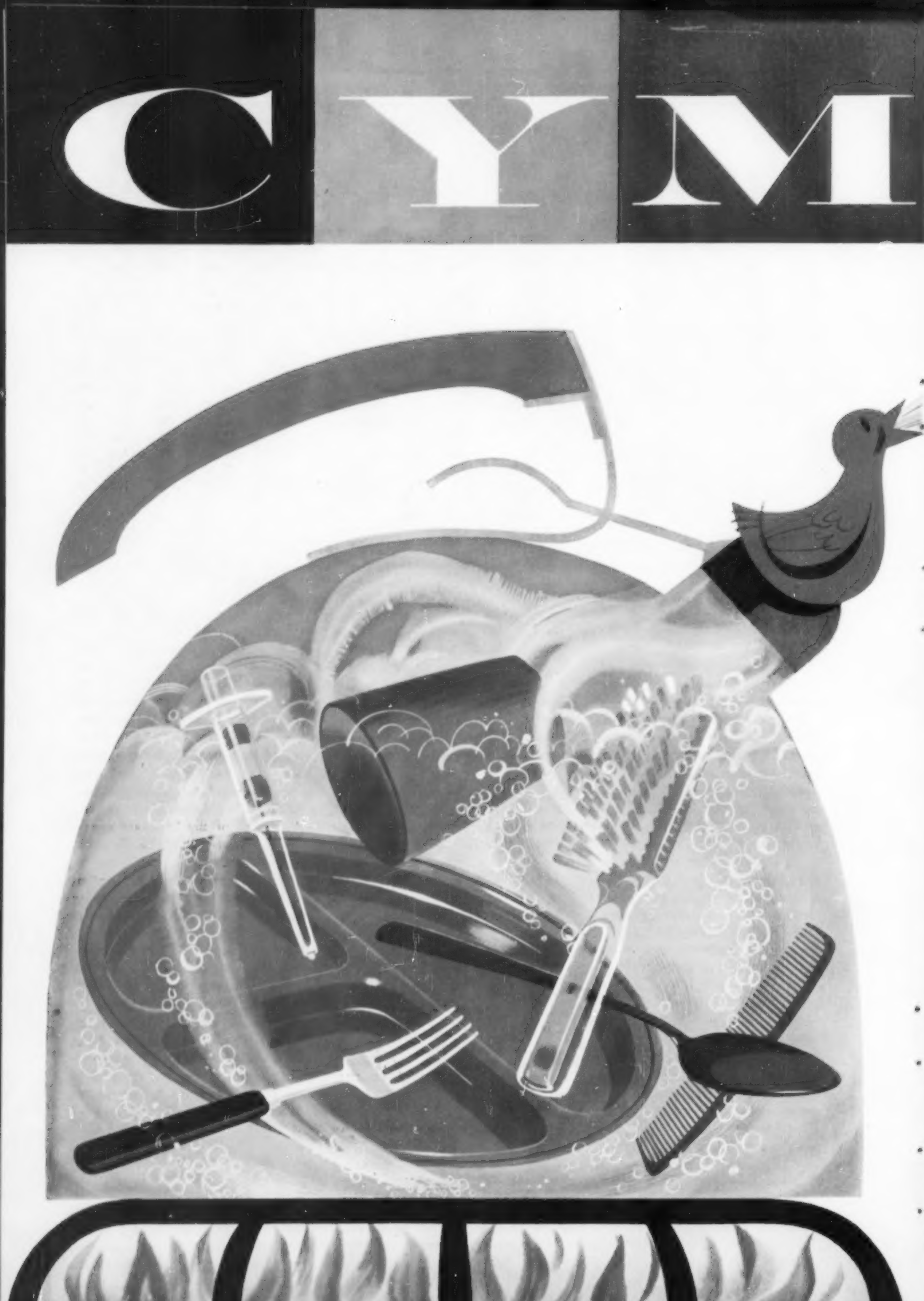


Fig. 1: Adiabatic calorimeter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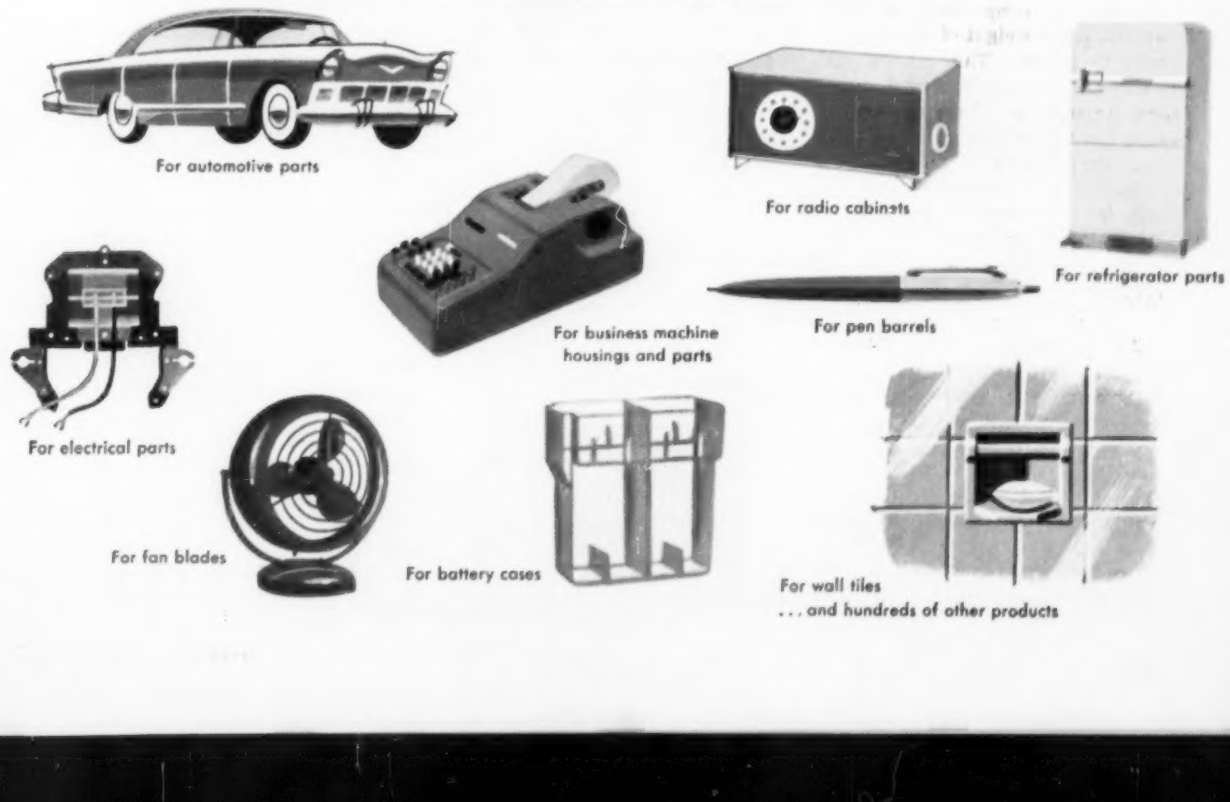


Table III: Heat capacities of the laminates

Laminate code No.	*Temp. range*	*Constants[a] in eq.: $C_t = A + Bt + Ct^2$* A	B	C
Fabric variation	*°F.*			
GY-A	85-500	0.293	-2.00×10^{-4}	7.23×10^{-7}
GY-B	85-600	0.197	2.135×10^{-4}	5.395×10^{-8}
GY-C	85-500	0.206	2.97×10^{-4}	2.73×10^{-7}
GY-D	85-600	0.256	5.1×10^{-5}	3.1×10^{-7}
Resin content variation				
GY-E	85-500	0.246	2.5×10^{-5}	-7.7×10^{-8}
GY-F	85-500	0.266	-1.05×10^{-5}	3.1×10^{-7}
GY-G	85-500	0.241	2.54×10^{-4}	-3.86×10^{-7}
GY-C (see above)				
Resin type variation				
CTL-A	85-600	0.196	2.42×10^{-4}	-4.94×10^{-8}
S	85-600	0.198	1.96×10^{-4}	0.867×10^{-8}
DC	85-600	0.242	-5.76×10^{-5}	3.08×10^{-7}
AC	85-600	0.236	3.39×10^{-4}	2.65×10^{-7}
GY-C, E, F, G (see above)				
Mat variation				
CTL-B	85-600	0.214	1.69×10^{-4}	-1.30×10^{-7}
CTL-C	85-600	0.196	3.39×10^{-4}	-9.93×10^{-8}
CTL-A (see above)				
Void variation				
GY-I	85-500	0.177	3.75×10^{-4}	-2.2×10^{-7}
GY-C, E, F, G (see above)				
Thickness variation				
GY-H	85-600	0.242	-1.33×10^{-4}	1.88×10^{-7}
GY-C, E, F, G (see above)				

[a] t = °F.

weight, B.t.u./lb., K is a calorimeter constant, t_1 is the final calorimeter cup temperature in °F., t_2 is the initial specimen temperature in °F., t_3 is the initial calorimiter cup temperature in °F., and w_s is the weight of the specimen in pounds. This procedure permits a curve to be drawn giving the enthalpy of the specimen as a function of the initial specimen temperature.

Assuming a quadratic expression for the specific heats of the laminates of the form:

$$C_t = A + Bt + Ct^2$$

then:

$$\Delta h = \int_{t_1}^{t_2} C_t dt = \int_{t_1}^{t_2} (A + Bt + Ct^2) dt$$

Integrating this expression and applying the limits, we obtain:

$$\Delta h = A(t_2 - t_1) + \frac{B}{2}(t_2^2 - t_1^2) + \frac{C}{3}(t_2^3 - t_1^3)$$

The temperature t_1 becomes the reference temperature (85° F.). Three values from the temperature-enthalpy curves are required to establish the values of the constants A, B, and C. The numerical values for these constants are given in Table III, above.

In examining the results of the specific heat determinations, it is apparent that the changes in the characteristics of the laminates at the elevated temperatures contribute some degree of uncertainty in the specific heat values at the higher temperatures. Since these changes in resin characteristics are almost certainly a function of time as well as of temperature, the specific heat values should be viewed with some caution in the high temperature range, especially if exposure to these temperatures is intended to be for any extended period of time.

It was also noted in making these specific heat measurements that there was some variation in characteristics of the laminates between supposedly identical sheets. Cause for this variation is inherent to at least some extent in non-homogeneous materials of this type. Because of the averaging effect of the heat content curves, the specific heat values determined on test specimens by this procedure should be fairly indicative of specific heat values expected from production laminates.

The specific heat equations given in Table III have been grouped to show the influence of the various laminating variables on the specific heat values. The major changes in specific heat values were expected to come from changes in resin content and changes in type of resin. However, on the basis of the test conducted, any correlation between specific heat values and resin content or type of resin used is not recognizable.

Thermal expansion

Thermal expansion of the laminates was determined in the plane of the sheet and through the thickness by means of a quartz tube dilatometer as shown in Fig. 2, left.

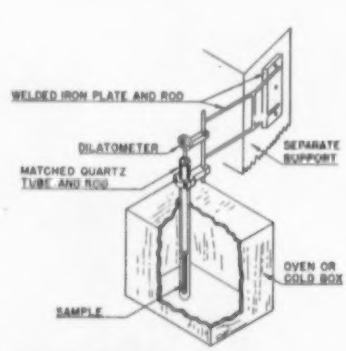
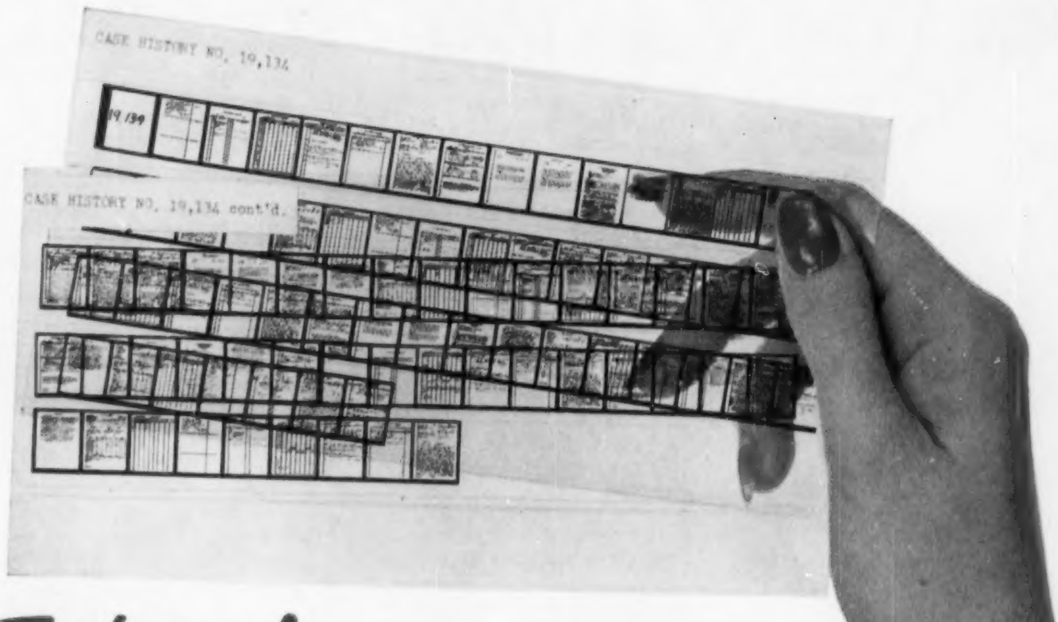


Fig. 2: Diagram of thermal expansion apparatus

The dilatometers were checked first with no specimen, to determine whether a correction would be required for the expansion of the quartz, and second with an electrolytic copper specimen to determine the accuracy of the expansion measurements. The first of these checks indicated that no correction for the quartz would be required since the expansion of the inner tube is just compensated by the expansion of the outer tube. The check with the electrolytic copper specimen gave expansion values that agree to within 0.1% with the expansion



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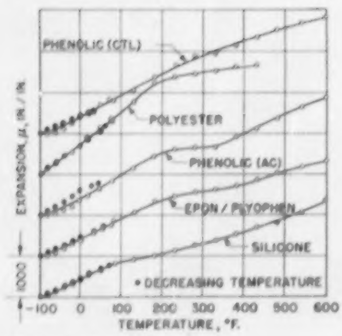

Fig. 3: Thermal expansion of plastic laminates in plane of lamination 90° to direction of lamination

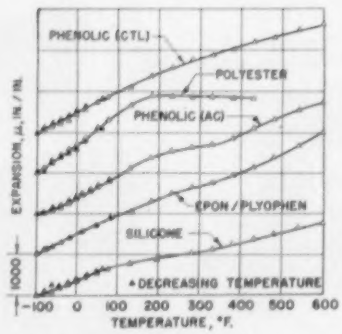

Fig. 4: Thermal expansion of plastic laminates in plane of lamination 45° to direction of lamination

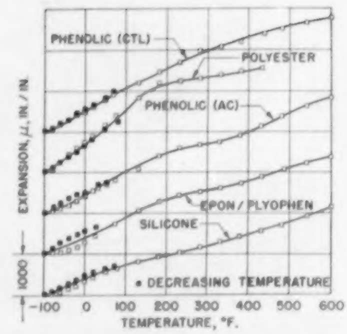

Fig. 5: Thermal expansion of plastic laminates in plane of lamination parallel to direction of lamination

of electrolytic copper as given by Smart.[1]

The expansion characteristics of the fibrous glass laminates are complicated by the non-homogeneous nature of these materials, the extent of cure, postcure, and the decomposition of the resin upon exposure to temperatures in the range 200 to 600° F. Unlike metals and most other homogeneous constructional materials, the fibrous laminates show different expansion characteristics through the thickness and in the plane of the sheet. Furthermore, the expansion characteristics are different in the plane of the sheet depending upon whether the expansion is taken parallel, transverse, or diagonal to the direction of lamination. This effect is, of course, minimized in the case of cross-laminated materials and completely randomized mats.

[1]Smart, J. S., Jr., "Properties of Copper and Copper Alloys," Metal Handbook, 1948.

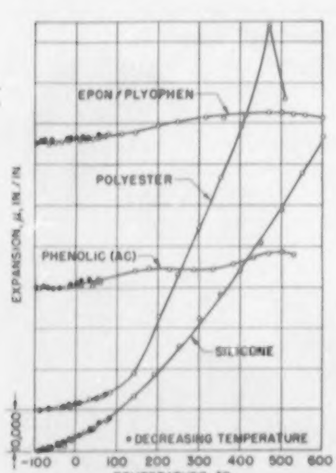

Fig. 6: Thermal expansion of plastic laminations through the thickness

Expansion curves, typical of those for parallel lay-up laminates in the plane of the sheet, are shown as a function of temperature in Figs. 3 to 5. In these curves, there are several distinct slopes, indicating that the expansion coefficients change depending upon the range of temperature involved. The initial expansion is probably due to dimensional changes in the resin material. As the sample increases in temperature, the glass fabric, having a lower coefficient of expansion, presents a loading effect on the resin and prevents it from expanding at the same rate, causing the leveling off of the expansion curves in the 100 to 300° F. range. As the temperature increases further, the resin becomes softer and the restraining force of the glass fabric becomes less as the glass tends to slip in the softer bond, and again the expansion rate increases to approximately that noted in the lower temperature range. These rate changes occur in varying magnitudes according to whether the expansion is taken parallel, perpendicular, or diagonal to the direction of lamination.

Expansion through the thickness, in general, is greater than that in the plane of the sheet since the fabric offers less resistance to the expansion of the resin in this direction. Variation in extent of cure and inherent differences in thermal expansion characteristics probably cause the major difference between the expansions. Evidently, this effect is far more noticeable in thickness expansion than in the plane of the sheet. Laminates of polyester and silicone resins exhibit greater coefficients of expansion than those laminates containing phenolic or Epon/Plyophen resins. Figure 6, left, shows the expansion curves of several laminates containing these resins. Variation in fabric seems to have very little effect on the expansion characteristics.

Thermal conductivity

Thermal conductivity determinations were made using the standard guarded hot-plate apparatus. A central heating element between two specimens supplies heat which flows through the specimens normal to the surfaces. Normal heat flow was assured by means of a guard ring and separately controlled guard (*To page* 232)

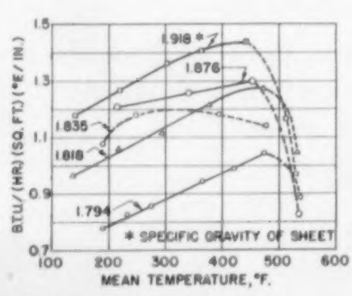

Fig. 7: Variation of thermal conductivity with polyester resin content

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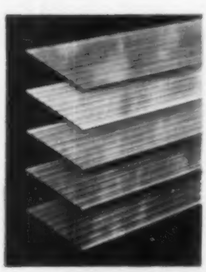

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Plastics Digest*

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. For complete articles, send requests direct to publishers. List of addresses is at the end of Plastics Digest.

Materials

Effect of glass fibers on cure of silicone resins. H. A. Clark and K. R. Hoffman. Ind. Eng. Chem. *48*, 104-06 (Jan. 1956). Silicone resin hydrolyzates have an acid number due to some of the hydroxyl groups that remain on the silicon atoms. The hydroxyl groups that cause this acid number may be removed without removing a proportionate amount of the total hydroxyl groups present. A method was developed for the evaluation of this acid number. The higher this acid number is, the slower the cure rate of the resin will be. Properly cleaned glass cloth, which is uncontaminated by cleaning reagents, may have an acid reaction in organic mediums. This reaction can be shown both by use of the acid number solution used for resins, and by determining the gel time of a silicone resin with glass present. Two methods for the evaluation of this effect of glass cloth on the cure of silicone resins are outlined and compared. Both methods are empirical, but should be of value to the fabricator of silicone-glass structures.

HD polyethylene plastic. Chem. Eng. News *34*, 1470, 1475 (Mar. 26, 1956). A new high density polyethylene made by Imperial Chemical Industries by a modification of the high-pressure process is described. The plastic has a higher softening point and is more rigid than the usual product made by high-pressure process. It can be sterilized at 110° C. without distortion.

Fire-resistant properties of PVC and related polymers. S. J. Skinner and S. E. Bolam. Rubber & Plastics Age *37*, 169-72 (Mar. 1956). The production and applications of fire-resistant polyvinyl chloride plastics are discussed. The effects of plasticizer and special fillers are reported.

Future foam-up. Chem. Week *78*, 62, 64-66 (Mar. 10, 1956). Properties and costs of foams made of rubber, vinyl chloride resins, and isocyanate resins are compared.

Better "nylon" in the making? Chem. Week *78*, 54, 56 (Mar. 31, 1956). A new group of polymers, the polyoxamides, are described. They are related to the nylons in chemical structure.

Hardening of resins during pulpwood storage. E. K. Thommen. Paper Trade J. *139*, 17-18 (Nov. 28, 1955). Coniferous wood is often seasoned for a year or longer to minimize pitch troubles in the sulphite mill. During seasoning the resinous substances in the wood undergo certain physical or chemical changes that reduce stickiness. The beneficial results are usually credited to absorption of oxygen by the resins; however, analysis of the resin from fresh and stored chips indicates that the hardening of the natural resin during wood seasoning is governed by a maturing process proceeding independently of the presence of oxygen.

Fillers and reinforcements for molded plastics. G. Lubin. Product Eng. *26*, 178-82 (Dec. 1955). Fillers in the form of fibers and powders are added to resins, such as phenolics, polyesters, and epoxides, to give improved properties, reduction in cost, and better finish. Powders have little effect on strength but may reduce processing or molding cost, produce an optimum value for a specific property, add a color where needed, or reduce water absorption. Fibrous fillers are effective in increasing the strength and stiffness; longer fibers, within limits, give higher strength. The strongest fibers give the highest strength, increasing with filler content up to an optimum point. For mechanical applications, glass fiber is the major reinforcement used; it is employed in the form of fabric or nonwoven mat. Surface appearance of low-pressure laminates is improved by the addition of powdered fillers or by the use of surfacing sheets. Powdered fillers control shrinkage during cure by promoting more uniform temperature conditions. Thixotropic fillers assist greatly in the control of molding characteristics and gel time. Finely divided silicon dioxide exhibits an unusually high degree of thixotropy; varying the content between 2 and 5% permits adjustment of viscosity and thixotropic characteristics of the resin over a wide working range.

Molding and fabricating

Chemical and physical problems arising during the manufacture and forming of thermoplastic sheet and film. H. Moritz and R. Ewald. Kunststoffe *46*, 195-98 (May 1956). Methods of test for the formability of thermoplastic sheet and film by vacuum techniques were investigated. Tensile tests in the rubbery elastic region can be used to study the formability of a thermoplastic sheet. The chemico-technical problems of these phenomena are discussed.

Vinyl foams made by atmospheric-pressure method. Plastics Tech. *2*, 246-47 (Apr. 1956). A process for making expanded plastics of polyvinyl chloride is described.

Applications

Adhesives as a design tool. A. E. Kott. Elec. Mfg. *57*, 87-93 (Feb. 1956). The major types of adhesives are reviewed and their properties are related both to types of materials to be bonded and to product applications. The advantages and disadvantages of

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adhesive joints as compared with bolted, riveted, clamped, soldered, or spot-welded joints are listed. Factors to be considered in selecting adhesives for particular applications are comprehensively discussed. Information on surface preparation, automatic assembly methods, and typical applications is given.

Isocyanate - resin - coated glass cloth insulation. H. G. Steffens. Elec. Mfg. *57,* 114-15 (Jan. 1956). An isocyanate-resin-coated cloth now available commercially is capable of continuous performance in the neighborhood of 150° C. and possesses superior resistance to crazing as compared with other coated glass materials. It falls short of the minimum requirements for Class H insulation as defined by silicone-resin-glass, but it far exceeds the Class B limits defined by oleoresinous varnished glass insulation. The effects of heat aging, flexure, and stretching on the dielectric properties of isocyanate-resin-coated glass are detailed in several charts and graphs. The superior adhesion characteristics of the isocyanate - resin - coated glass cloth permits its use for cable insulation, where resistance to the production of discontinuities between resin and glass fiber during weave-shift on bending is an essential property.

High-quality plastics components for guided missile and airborne radar systems. W. Crofut and L. B. Keller. Plastics Tech. *2,* 237-45 (Apr. 1956). Problems involved in making high quality plastics components for guided missiles and airborne radar systems are discussed. At the present time, high-quality plastics materials that can meet the requirements of missile and airborne radar systems are available. However, the required methods of raw material inspection, accurate process control, and part inspection have not been developed generally to an extent sufficient to assure uniform and reliable components. A wider application of methods similar to those described could significantly advance the uniformity and reliability of plastic parts. New materials will be developed to meet the even more rigorous requirements foreseen for future systems, particularly with respect to very high temperatures. To meet the competition other materials will offer, techniques of close inspection and accurate process control will have to be applied to the fabrication of high-quality plastics components. If this is done, plastics can fulfill their inherent promise of adaptability to these applications.

Casting resins insulate and protect electronic components. H. L. Loucks. Materials & Methods *43,* 90-94 (Feb. 1956). The selection of casting resins suitable for the embedment, encapsulation, and impregnation of electronic components depends on the environmental conditions to be encountered and on design requirements. Polyester and epoxy resins, foam-type resins such as polyisocyanates and polystyrenes, and elastomeric resins such as polysulfides and silicone rubber compounds are discussed. Their chemical and physical properties, methods of application and cure, and their advantages and limitations are discussed in considerable detail.

Properties

Arc forming of plastics in electrical appliances. K. Schumacher. Elektrotech. Z. *76,* 369-76 (1955). The insulating capacity of plastics in electrical appliances can be lost by decomposition of the material. At high temperatures thermosetting and some thermoplastic materials develop strong carbonization. While the amount of residue depends on the chemical composition of the plastic, the conductivity decreases considerably at about 400° C. and increases again at 500° C. At 800° C. it is about the same as ground graphite. For most plastics a temperature of 500° C. is critical because in this region the conductivity is sufficiently high and enough residue is present to cause arc forming. Many thermoplastics evolve volatile compounds and are therefore not able to produce an electric arc. Plastics with inorganic fillers and silicones can form an electric arc when the organic part of the residue contains sufficient carbon. The arc resistance of a plastic is therefore dependent on its chemical structural unit.

Effect of surface coatings on the plasticizer migration of polyvinyl chloride upholstery materials. H. E. Frey. Kunststoffe *46,* 81-86 (Feb. 1956). The effect of surface coatings on the plasticizer migration was investigated using a modified "Rub-Off" test. The effect of various coatings on the evaporation and migration of the plasticizer into a sheet of natural, vulcanized rubber was also tested. The following coatings were investigated: two vinyl chloride copolymers of different molecular weight, polymethyl methacrylate, polyethyl methacrylate, polyester isocyanate, nylon, and two compositions of methacrylate resins. Only polymethyl methacrylate and nylon have a protective effect of any practical value.

Improvement of bonding properties of polyethylene. K. Rossman. J. Polymer Sci. *19,* 141-44 (Jan. 1956). If the surface of a polyethylene film is subjected to certain treatments, printing on the surface becomes possible; in other words, the bonding properties of the polyethylene film are improved. Two forms of treatment, involving the use of a Tesla coil discharge at atmospheric pressure and of a glow discharge at reduced pressure, were developed. Through the use of a Beckman IR-3 spectrophotometer, it was found that the treatments cause formation of unsaturated ($C=C$) bonds and carbonyl ($C=O$) groups in the polyethylene molecule. The improved bonding properties may be due to oxidation of the plastic surface.

Spectral-transmissive properties of plastics for use in eye protection. A.S.A. Committee on Eye Protection. American Standards Association Report, 48 p. (1955). The ultra-violet, luminous, and infra-red spectral-transmissive and other characteristic data on many of the presently available types of plastics suitable for use in protecting eyes in industrial

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and certain other operations are presented. Important consideration is given to the use of plastics in those circumstances wherein their use is comparable to that of glass. Caution is given against their use in certain cases and situations wherein their spectral-transmissive qualities, as they bear on invisible radiations, are a factor that may limit their use as a protection against such hazards.

Testing

Glass-reinforced plastics inspection techniques found. Industrial Labs. 7, 14 (Apr. 1956). Ultrasonic and radio frequency techniques are used to measure the thickness and locate flaws in glass-reinforced plastics.

Ball-drop technique for estimating polyethylene film toughness. R. H. Supnik and C. H. Adams. Plastics Tech. 2, 151-57, 178 (Mar. 1956). A ball-drop technique for estimating the toughness of polyethylene film is described. The many variables studied included specimen size, velocity of impact, diameter of impinging surface, and sample variation. A statistical method was developed which gave an effective measure of resistance to shock impact for thin film. The procedure consists of dropping a dart from a fixed height onto the film mounted in a hoop and centered in a positioning frame. The dart is composed of a hemispherical phenolic base and an aluminum shaft with removable weights. After the weight range for break-through is established, the percent failure in ten samples is determined for each of four dart weights. Percent failure is then plotted against weight of dart. The slope of the straight line obtained, together with the weight at which 50% of the samples fail, clearly defines film toughness under these conditions. Reproducibility within and between operators was very good for a limited number of resins of different toughness levels. No correlation was observed between uni-axial data and ball drop impact values. Thus, the method provides an independent measure of toughness, and should prove valuable as an evaluation technique for characterizing polyethylene resins and studying the effect of processing conditions on film quality.

Publishers' addresses

American Standards Association: 70 E. 45th St., New York 17, N.Y.

Chemical and Engineering News: American Chemical Society, 1115 Sixteenth St., N.W. Washington, D.C.

Chemical Week: McGraw-Hill Publishing Co., Inc., 330 W. 42nd St., New York 18, N.Y.

Electrical Manufacturing: The Gage Publishing Co., 1250 Sixth Ave., New York, N.Y.

Elektrotechnische Zeitschrift: VDE-Verlag G.m.b.H., Friedrich-Ebert Strasse 111, Wuppertal-Elberfeld, Germany.

Industrial and Engineering Chemistry: American Chemical Society, 1115 Sixteenth St., N.W. Washington 6, D.C.

Journal of Polymer Science: Academic Press, Inc., 125 E. 23rd St., New York, N.Y.

Industrial Laboratories Publishing Co.: 201 North Wells St., Chicago 6, Ill.

Kunststoffe: Karl Hanser Verlag, Leonhard-Eck-Strasse 7, Munich 27, Germany.

Materials and Methods: Reinhold Publishing Corp., 430 Park Ave., New York 22, N.Y.

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Plastics Technology: Bill Brothers Publishing Corp., 386 Fourth Ave., New York 16, N.Y.

Product Engineering: McGraw-Hill Publishing Co., 330 W. 42nd St., New York 18, N.Y.

Rubber and Plastics Age: The Rubber and Plastics Age, 147 Grosvenor Rd., Westminster, London S.W. 1, England.

U.S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each

Polymerization. W. O. New, Jr. and M. Crowther (to Arnold, Hoffman). U. S. 2,739,959 Mar. 27. Polymerization of pyrrolidone and piperidone.

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Foam. J. L. McCurdy and C. E. DeLong (to Dow). U. S. 2,740,157, Apr. 3. Apparatus for shaping plastic foam.

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Molding. R. B. McKee, Jr. and C. E. Beyer (to Dow). U. S. 2,740,160, Apr. 3. Plasticizing torpedo for die expressing machine.

Casting. L. C. Rubens and R. F. Boyer (to Dow). U. S. 2,740,161, Apr. 3. Resin casting method.

Embedding. R. W. Ogle. U. S. 2,740,192, Apr. 3. Embedding a hollow needle in plastic material.

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Copolymers. R. I. Longley, Jr., E. C. Chapin, and R. J. Smith (to Monsanto). U. S. 2,740,771, Apr. 3. Vinyl ester copolymers.

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Cellulose esters. L. J. Rosen, A. J. Pikor, and B. B. White (to Celanese). U. S. 2,740,776, Apr. 3. Cellulose esters.

Extrusion. G. E. Henning (to Western Electric). U. S. 2,740,988-9, Apr. 10. Extrusion apparatus.

Molding. R. A. Bruner (to General Motors). U. S. 2,741,012, Apr. 10. Automatic molding machine.

Extrusion. P. Billen and W. Haendler (to Schloemann). U. S. 2,741,363, Apr. 10. Extrusion press.

Polymers. T. F. Bradley and A. C. Mueller (to Shell). U. S. 2,741,607, Apr. 10. Polymers of triglycidyl cyanurate.

Resins. J. C. Lukman and O. L. Wheeler (to Shawinigan Resins). U. S. 2,741,650, Apr. 10. Styrene-modified polyvinyl acetate resins.

Resins. J. Been and M. M. Grover (to Rubber and Asbestos). U. S. 2,741,651, Apr. 10. Phenol-terpene resin heated with a phenol-aldehyde resin.

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Plasticizer. C. P. Albus and R. E. Field (to General Aniline). U. S. 2,742,371, Apr. 17. Cellulose esters and ethers plasticized with 1,6-hexanediol di-2-ethylhexoate.

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Resins. R. J. Fanning and R. J. Louthan (to Phillips Petroleum). U. S. 2,742,447 Apr. 17. Stabilization of polysulfone resins.

Resins. F. Schlenker (to Chemische Werke Albert). U. S. 2,742,449, Apr. 17. Improving the hardening characteristics of phenolic resins.

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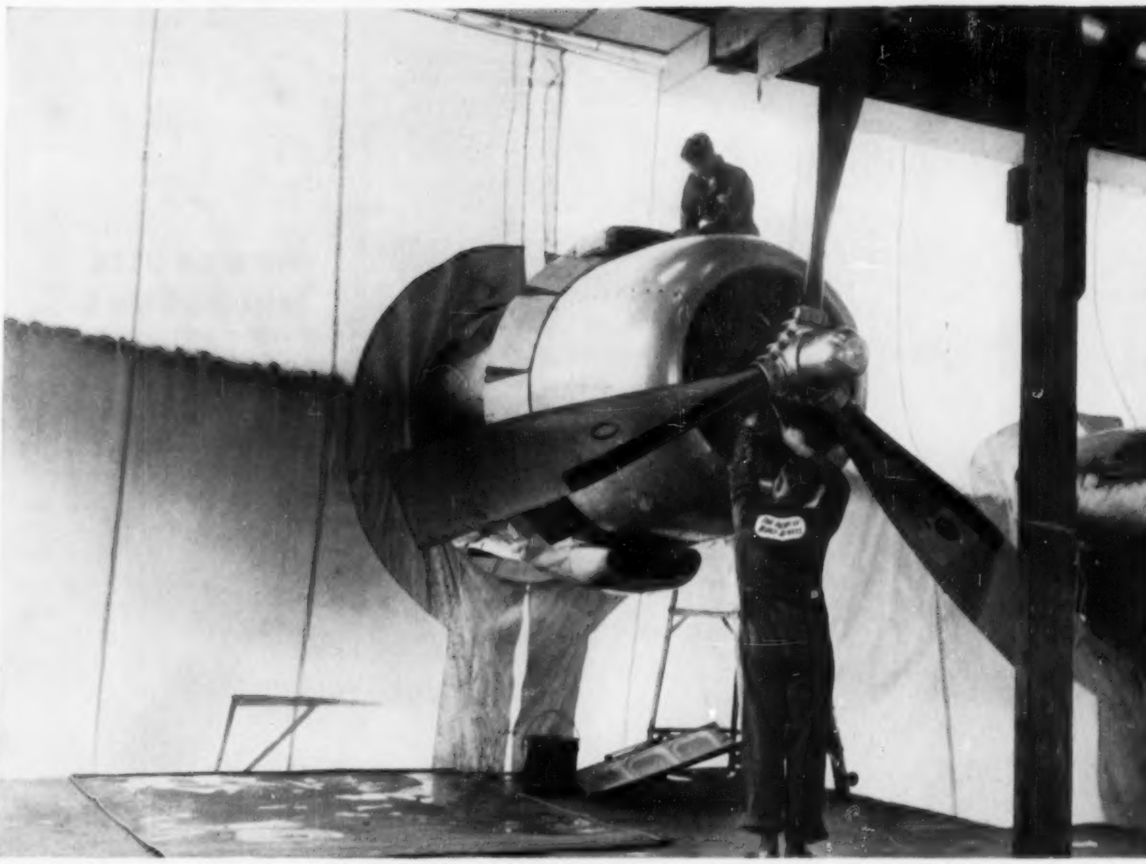

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densing diglycol esters of terephthalic acid.

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Resins. H. W. Coover (to Eastman Kodak). U. S. 2,743,258, Apr. 24. Alkane phosphonate polymers.

Resins. M. De Groote (to Petrolite). U. S. 2,743,259, Apr. 24. Hydroxylated phenolic resins.

Polymers. P. O. Tawney (to U. S. Rubber). U. S. 2,743,260, Apr. 24. Polymeric methylol maleimide resins.

Copolymer. H. W. Coover, Jr. and J. B. Dickey (to Eastman Kodak). U. S. 2,743,261-2-3, Apr. 24. Resinous copolymer of α-dibutylphosphonatostyrene and acrylonitrile.


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NOW, in our new location—in double the space we occupied at our former address—we are operating one of America's largest plants devoted exclusively to the production of cardboard partitions ...Customers' needs can be served better than ever before in our new and enlarged plant...Production is keyed to the steadily increasing demand for our specialized service.

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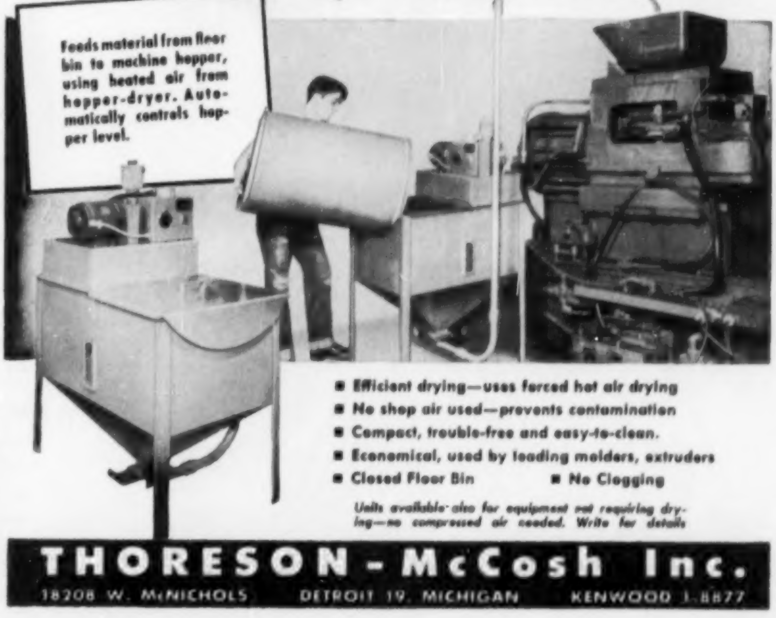
Dries as it loads

NEW Combination { D & W HOPPER DRYER with Automatic JET HOPPER LOADER

Feeds material from floor bin to machine hopper, using heated air from hopper-dryer. Automatically controls hopper level.



- Efficient drying—uses forced hot air drying
- No shop air used—prevents contamination
- Compact, trouble-free and easy-to-clean.
- Economical, used by leading molders, extruders
- Closed Floor Bin
- No Clogging

Units available also for equipment not requiring drying—no compressed air needed. Write for details

THORESON-McCosh Inc.
18208 W. McNICHOLS DETROIT 19, MICHIGAN KENWOOD 1-8877

New Machinery and Equipment*

Heating cylinder for vinyls

A replacement heating cylinder for vinyl injection molding is made in three pieces and has a hollow, oil-heated spreader. The oil heating of the spreader reduces thermal degradation of the heat-sensitive vinyls. The cylinder is built in threaded sections with a new lip-type register. It was designed for easy disassembly and quick cleanout with special oversize wrenches. More than two years of research and evaluation have preceded the introduction of this heater. *Injection Molders Supply Co., 3514 Lee Rd., Cleveland 20, Ohio.*

Heat sealer

A French heat sealer with an output of 12 kw. is especially well adapted to the heat-sealing of automobile inner door seals. The h.-f. oscillator operates at 27 mc. and uses a new output tube that will give twice the rated output while operating on a half-on, half-off cycle. The machine is equipped with a rotating work table that permits sealing with the work in any of four positions. It can seal an area of about 40 sq. in. in about 5 to 8 seconds. *Société de L'Electronique Française, 26 rue Malakoff, Asnieres (Seine) France.*

*Specifications and claims made and appearing in these pages are those of the manufacturers of the machinery and equipment described and are not guaranteed by MODERN PLASTICS.

Aid to drying molding powders

In the summer months, when the moisture content of the air is extremely high in much of the U. S., it is virtually impossible to dry hygroscopic molding powders (e.g., nylons and acetates) by passing undried air through them, even though it is very hot. Such treatment is more likely to increase than to reduce the moisture content of the molding powder. The Hi-Dri, an electrically operated dehumidifier, supplies dried air to powder driers. Particularly designed for use with D & W Hopper-Dryers, installation consists of connecting it to a 110-v. a.-c. source and making a hose connection to the intake blower of the dryer. *Thoreson-McCosh, Inc., 18208 W. McNichols Rd., Detroit 19, Mich.*

French-made heat sealer has 12-kw. output, comes with rotating work table that permits sealing with work in any of four positions

Measuring extrudate diameter

A sensing element using a light beam scanning at the rate of 240 times per sec. controls diameter of extruded wire insulation in the range from 0.4 to 3.0 in. to within 0.001 inch. The circuit of this instrument has been designed to make it insensitive to "smoking" of the hot jacketing compound at the extruder; thus it can be installed to measure the diameter before the extrudate enters the water bath. Since there is no mechanical contact with the moving wire, and since the measurement is made immediately after the wire leaves the extruder, considerable reduction in rejected material can be realized. The instrument may be adapted to controlling the outside diameter of extruded tubing and rod. *Industrial Gauges Corp., West Englewood, N. J.*

Vacuum pumps

By using a radiator-cooled system instead of the usual water-cooled set-up, two new vacuum pumps can produce vacuums of from 24 to 29.9 in. Hg at temperatures of only 140° F. obtained by circulating the pumping oil through a fan-cooled radiator. This permits pump speeds up to 800 r.p.m., which are said to provide greater capacity in smaller pumps. The need for water piping is eliminated. The Model 29-3 can pump 21 cu. ft./min. at no vacuum with a speed of 800 r.p.m., and 7.6 cu. ft./min. at 1 in. Hg absolute, while the Model 29-6 can pump twice these volumes at the same speed. *Leiman Bros., Inc., 102 Christie St., Newark 5, N. J.*

Hydraulic circuit tester

Flows, pressures, and temperatures in hydraulic systems such as those used in hydraulic presses and molding machines can be quickly checked with the Model PT-50-B tester. The tester is portable, can measure pressures

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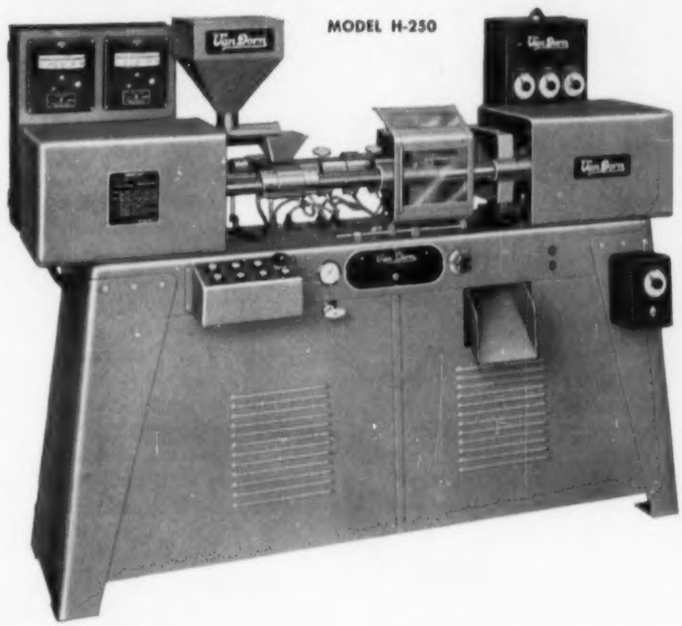
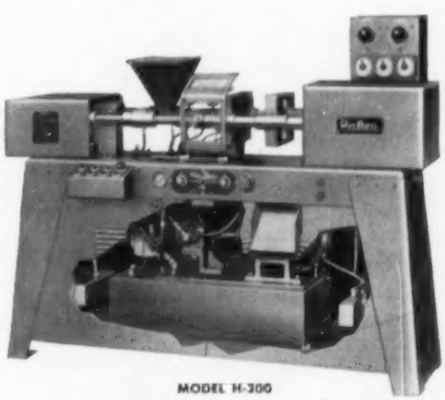
AUTOMATIC OPERATION AT LOW COST

This high speed 2½ oz. injection press plasticizes material at 22 lbs. plus per hour, and attains up to 720 cycles per hour (dry run). High efficiency due to *water cooled* plunger, transfer hopper, and oil cooler. Accessible platen clamp device insures easy purging to change material. For safety, press will not operate unless part is fully ejected. Simple operation due to automatic, adjustable material metering device. Press requires little attention during production. May also be operated semi-automatically. All steel construction.


MODEL H-250


MODEL H-300

SEMI-AUTOMATIC 2 OZ. PRESS

Up to 10 cycles per minute. Safe, simple push button controls. Accurate temperature regulation. Rugged, compact, quiet.


MODEL H-200

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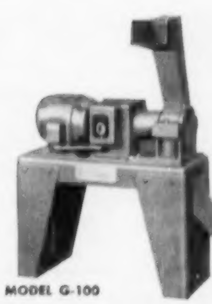
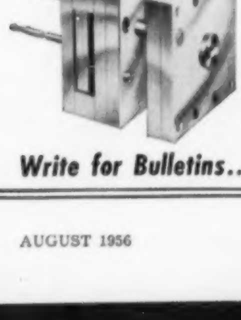
2 oz. or 1 oz. Operate 8 hours for under a dollar and use inexpensive molds. Easily set up in twenty minutes.


MODEL G-100

PLASTIC GRINDER

Grinds up rejects, waste, etc., for re-use. Ruggedly made, designed for easy cleaning.



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Schroeder PT-50-B hydraulic circuit tester has 300- to 2000-p.s.i. range.

in the range from 300 to 2000 p.s.i. with a probable accuracy of ± 5 percent. Flows up to 50 gal./min. and temperatures ranging from 60 to 220° F. can be simultaneously measured. *Schroeder Bros., 3116 Penn Ave., Pittsburgh 1, Pa.*

Rotating fluid joint

A rotating joint that can handle two separate streams turning on different centers practically eliminates the breakage of syphon tubes in the high-pressure hot-water systems of calenders. The joint, which is mounted solidly to the machine, is available in the 2-, 2.5-, 3-, and 4-in. sizes *Rotherm Eng. Co., 7280 W. Devon Ave., Chicago 31, Ill.*

Molecular erosion cuts hardest materials

Brass tools can be used to cut Carboloy by means of a high-voltage, rapidly pulsating d.-c. spark discharge that erodes the surface being worked into the desired shape. The molecular erosion machine is capable of removing material at rates up to 4 cu. in./hr., holding tolerances of 0.0005 in., and finishing surfaces to 10-microinch smoothness. The circuits of the 4.5-kw. device are designed to give a very sharp spark discharge that can be used at four working speeds: roughing, semi-finishing, finishing, and microfinishing, with separate regulation of intensity at all four speeds. The "cutting head," which may be made in whatever shape and size is needed for the job, is essentially motionless. It is fitted with a soft metal electrode formed in the pattern to be cut, and is automatically positioned to maintain a fixed gap at all times. It doesn't get hot. The machine is said to work hard materials rapidly and has successfully replaced diamond tools in the grinding of carbide wheels. The material being worked must be at least a fair electrical conductor. *Abaco Industries, Inc., 78-21 Queens Blvd., Elmhurst, L. I., N. Y.*

Fire-resistant hydraulic fluid

A new hydraulic fluid, Irus Fluid 902, does not burn when exposed to flames, heated surfaces, or molten metal. It is composed of water, petroleum hydraulic oil, and emulsifying agents and is particularly useful where leaks or line breaks would result in fires or explosions with ordinary hydraulic oils. Irus 902 also has the other characteristics needed in a hydraulic fluid and is not corrosive in ferrous and most nonferrous systems. It can replace any conventional mineral or synthetic oil without modification of equipment. *Shell Oil Co., 50 W. 50th St., New York 22, N. Y.*

Film winder

The Type WS winder was developed for use with take-ups for extruded film where low tensions at low speeds are needed. It is said to eliminate distortion of delicate webs after extrusion. The winding speed is automatically adjusted downward as the roll builds up and the torque increases. The basic take-off rate is manually adjustable. *Hobbs Mfg. Co., 26 Salisbury St., Worcester, Mass.*

Versatile heating panels

Infralite heating elements for use in plastic sheet forming can accommodate sheet sizes from 8 by 12 in. to 4 by 6 ft., up to ¼ in. thick. The elements bolt together to give variously sized and shaped panels. With proper electric switching, large and small sheets may be heated with the same panel. *N. J. Thermex Co., Inc., 533 Bergen St., Harrison, N. J.*

Marking machine

The larger Model 9AH marking machine, originally engineered to mark metals, is now adaptable with slight adjustments to marking plastics. Up to 1000 marks per hr. can be made, depending on the size of part and feeding technique. Standard stroke is 6 in., but long-stroke models are also available. Acroleaf feed is positive and automatic, insuring high-quality marking. The marker is powered by compressed air at 150 p.s.i. and is equipped with an electric heating element. *The Acromark Co., 5-15 Morrell St., Elizabeth, N. J.*

Cloth or film let-off

A heavy-duty, center-bar let-off has heavy phenolic casters on which the center-bar rotates. Guides hold the center-bar laterally so that the brake drum and bands are perfectly aligned. A self-locking clamp holds the center-bar in place, from which it is released by a foot treadle. The brakes are designed to work equally well with either direction of let-off rotation. Tension is automatically released when film is running. applied when the machine being fed is stopped. *Mount Hope Machinery Co., Taunton, Mass.*

Explosion-proof viscometer

A new Brookfield viscometer has been designed for use in situations where standard equipment would present explosion and fire hazards. Equal in performance to earlier models, the new one is completely enclosed in a case machined from solid aluminum and has been approved by the Underwriters Laboratories. All immersible parts are stainless steel. *Brookfield Eng. Labs., Inc., Stoughton, Mass.*

Large chrome-plater

A large-capacity chrome-plating unit, the Chromeplater 300, is especially designed to plate large metal forming dies and plastics molds. It can plate pieces up to

Mechanical Sculptor

CARVES BIG MOLDS

With feather-light touch, the tracer of this huge die sinking machine passes over the surface of a master pattern. The slightest change in contour is transmitted by a varying electric current to the cutter, which faithfully reproduces every intricate detail of the pattern in the mold cavity.

From the mold shown, Bridgeport Moulded Products Co., Inc. produced the handsome grille of the Philco air conditioner pictured in the inset—one of the hundreds of fine products for which molds have been created by the skilled hands and modern facilities at Newark Die Company.

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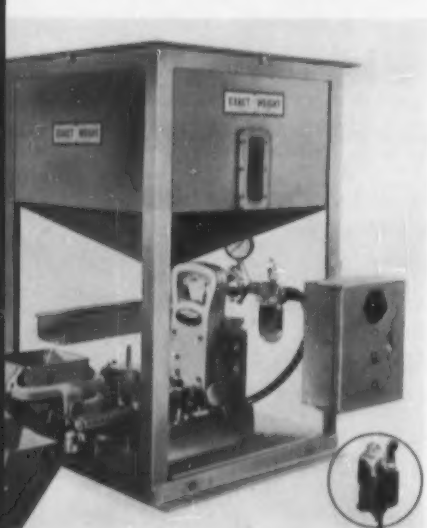
NDCo TRADE MARK

15 by 20 by 30 in. deep. The plater is equipped with two 3000-w. immersion heaters and a water jacket for temperature control. A special feature is the plastisol-covered steel work platform with a screw adjustment for height, said to give maximum plating efficiency. The rectifier provides 300-amp. d.c. to the bath and operates on a standard 200-v., 3-phase a.c. A smaller companion unit supplies 75 amp. and has an available volume of 13 by 13 by 12 inches. *Dawson Corp., 302 Fifth Ave., North Pelham, N. Y.*

Plunger-positioning weigh feeder

An automatic weigh feeder for injection molding is said to make possible unattended operation, by controlling the position of the injection plunger at the end of the stroke. The plunger can be set to "bottom," if desired, or to operate on a predetermined cushion. Aside from the weighing apparatus featured on earlier models, this feeder incorporates a device that senses the position of the plunger. The shot is weighed in two parts, major and minor. If the cushion gets too thick, i.e., if the plunger does not travel far enough, the minor fraction is omitted until the required cushion is re-established. Machines are available with bucket capacities of 32 and 50 oz. and hopper capacities of 100 lb. (or more with optional hopper extensions). *The Exact Weight Scale Co., 944 W. Fifth Ave., Columbus, Ohio.*



Exact Weight feeder using major and minor feed charges. Ram position detector, which is fastened to injection machine, is shown in circled inset

Fabric stiffness tester

The improved Drape-Flex stiffness tester for testing sized and resin-treated fabrics, coated fabrics, plastic film, etc., conforms to the requirements of the new A.S.T.M. method D-1388-55T for stiffness testing. The angle of inclination has been reduced from 43° to 41.5°, a level has been built in, and adjustments have been added. The new reversible scale permits reading results in either inches or centimeters. *Fabric Development Tests, P.O. Box 45, Brooklyn 32, N. Y.*

Blender

The Nauta Mixer has a unique mixing action that permits uniform mixing of any number of different materials. The action is gentle enough so that there is no dusting. The body of the mixer is conical and a revolving screw flight inside circulates the charge to give both vertical and rotatory blending. Small quantities of solid or liquid additives may be satisfactorily blended with large volumes of material. The blender can also be used to dissolve solids in liquid media. The mixer, being stationary, has no external moving parts. It may be jacketed for temperature control. It is quickly emptied by simply reversing the screw flight. *Buflovak Equipment Div., Blaw-Knox Co., 1543 Fillmore Ave., Buffalo 11, N. Y.*

Non-abrasive for polishing

Lustrar compound contains no abrasives at all and will not scratch the relatively soft surfaces of acrylics, aluminum, and copper. It is a polymerization product of a number of ingredients. It gently removes tarnish from metals, but should not be used on soft precious metals, furniture finishes, or lacquer-type auto finishes. It has been found especially satisfactory for polishing acrylic optical surfaces. Since it contains no water or other volatile solvents, it does not suffer from evaporation losses nor does it cause crazing of plastics. It can be used on buffing wheels, the best results being obtained with sewed wheels. *Louis P. Hershey Co., P. O. Box 1670, Old P. O. Station, Chicago 90, Ill.*

Steel for molds

A new medium-carbon alloy steel, called MC-Mold and Cavity Steel, is especially designed for dies and molds where high surface finishes are required. It can be uniformly hardened to 300-350 Brinell throughout cross sections as large as 20 by 10 inches. The low temperature used in carburizing this steel prior to oil quenching results in little or no cleavage of crystal boundaries during quenching. It takes a fine finish with little trouble from pits, and is particularly desirable for molding clear plastics. The alloying elements are carbon, silicon, manganese, chromium and molybdenum. The MC steel is available either annealed or heat-treated to 300 Brinell, in large rounds or blocks. *Vanadium Alloys Steel Co., Latrobe, Pa.*

Liquid-to-solids blender

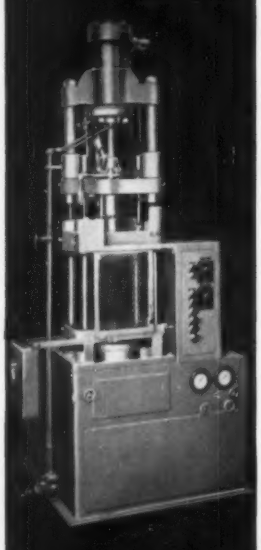
A twin-shell blender offered in seven sizes from 3 to 50 cu. ft. feeds the liquid into the blender by means of a cylindrical tube that rotates within the shell. Liquid flows from a feeder tube inside the main tube onto a revolving disk that flings the liquid into the solids in a fine spray. A stainless steel wire cage surrounding the feeder breaks up agglomerates. The device is said to achieve perfect blending of liquid and dry solids in minutes. *The Patterson-Kelley Co., 101 Fulton St., East Stroudsburg, Pa.*

Silent bin vibrator

A small bin vibrator for lightweight applications, the RC-5, weighing 25 lb., uses an eccentrically rotating weight. Operating on all common a.c. voltages, the RC-5 draws 100 w., delivers a 275-lb. impact, and makes no more noise than an electric motor. *Cleveland Vibrator Co., 2827 Clinton Ave., Cleveland 13, Ohio.*

HOW TO BOOST PRODUCTION

of intricate moldings and parts requiring inserts



The vertical method of injection molding offers many production-boosting benefits in turning out parts requiring loose cores and inserts. Loading trays are quickly positioned, and there's no need for elaborate holding devices . . . thanks to the horizontal moving platen. Other advantages: Less chance of mold damage; minimum floor space needed; assured stability of inserts during mold closing; convenient, comfortable working conditions for operator.

Vertical injection molding is also the answer to high-speed, low-cost production of conventional and small, intricate moldings.

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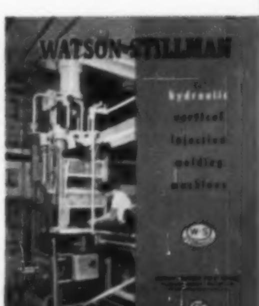

WRITE FOR THIS GUIDE TO INCREASED PRODUCTION!

Just off the press bulletin tells what is available in the W-S line of vertical injection molding machines. Gives design features, specifications, capacities, dimensions, etc.

WS-16

Books & Booklets

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Matieres Plastiques. Procedes de Transformation"

Published in 1956 by Presses Documentaires, 28, Rue Saint-Dominique, Paris, France. 342 pages. Price: 1,950 Fr. (ca. $5.85).

Companion piece to an earlier volume which dealt with the properties and uses of the most common plastics materials, the present work rounds out the subject by covering the field of practical plastics processing techniques. Topics discussed include the production of film and sheeting, laminating, extrusion, compression and injection molding, heat sealing, welding, adhesives and foams, metallization, and others.

The book, written by a group of engineers, is a summary of a course offered at the Centre Technique d'Eneignement Ouvrier and is recommended by the publishers for French-speaking purchasing agents, foremen, students, and possibly engineers and chemists.

"Chemical Market Research in Practice"

Edited by Richard E. Chaddock

Published in 1956 by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. 206 pages. Price: $3.00.

Written by 22 members of the Chemical Market Research Association, each a specialist in some phase of chemical market research, this book treats of the evolution of chemical market research, its relationship to basic research, products, and markets, and presents actual case studies. Nine chapters and seven case studies are devoted to organization, personnel, market surveys, literature, field work, and reports. Material was originally presented as lectures at Case Institute of Technology and through the University Extension Division of the University of Delaware. One chapter is devoted exclusively to the plastics industry.

"High-Temperature Technology"

Edited by I. E. Campbell

Published in 1956 by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 526 pages. Price: $15.00.

In the editor's words, "This monograph is intended both to acquaint the reader with recent developments in the field [of high-temperature technology] and to indicate the importance of established techniques and materials to modern high-temperature technology."

The book contains over 75 tables and more than 1100 references; 22 pages are devoted to author and subject indexes.

"American Architects' Directory"

Edited by Dr. George S. Koyl

Published in 1955 by R. R. Bowker Co., 62 W. 45th St., New York 36, N. Y. 748 pages. Price: $20.00.

This "Who's Who in Architecture" makes available for the first time pertinent data on some 11,000 active American architects. In each of the alphabetically arranged biographies there are complete details; home and business address of each architect, his achievements, positions he has held, education, professional affiliations, etc. A geographical cross-index to all architects listed enables readers to locate at a glance the leading architects of a particular area.

Epoxidized olefins. Structure, typical properties, and chemical reactivity of octylene oxide, dodecene oxide, and C_{16}-C_{18} olefin oxide are described in Bulletins Nos. 72, 73, and 74 respectively. They are used as intermediates, solvents, and specialty chemicals. 5 pages in each bulletin. *Becco Chemical Div., Food Machinery and Chemical Corp., Buffalo 7, N. Y.*

Urethane foam. Well-prepared booklet describes what urethane foams are, what makes them "special," and what they may be used for. Characteristics and properties are presented and fabricating techniques and procedures, including embossing, cutting, stamping, and sawing, are described and illustrated. 22 pages. *Mobay Chemical Co., 1901 S. Second St., St. Louis 4, Mo.*

Polymerization process. Details on the process of polymerizing ethylene, propylene, diolefins, etc., are given in a photostatic copy of a recent patent issued to Phillips Petroleum Co. Information on catalyst support as well as pretreatment of catalyst to change molecular weight is given in tables. 91 pages. $85. *Chemonomics, Inc., 270 Park Ave., New York 17, N. Y.*

Plastisol molding. Reprint of an article that appeared in MODERN PLASTICS Encyclopedia Issue, Sept. 1954, describes dip molding, slush molding, rotational molding, and low pressure injection molding of plastisols. 4 pages. *Watson-Standard Co., 225 Galveston Ave., Pittsburgh 30, Pa.*

Color pastes. Sample chips and a price list for color pastes that have been dispersed in a new non-monomeric polyester resin are presented in a brochure. Normal procedure for using the pastes, mixing information, and advantages are included. 4 pages. *Plastics Color Co., 233 Broad St., Summit, N. J.*

Plastics bearings. The application of plastics to roller and ball bearings is covered in detail in this report of a study undertaken to determine the best types of plastics for use as rolling elements in heavy-duty bearings. Included are data on plastics tested,

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If you're looking for a versatile brown phenolic molding compound that cures fast and produces pieces of unsurpassed quality, then you should investigate INDUR 205. Possessing excellent physical and electrical properties, INDUR 205 has an enviable record for a wide variety of molded articles, both by compression and plunger molding. INDUR 205 is quality-checked at every step of production, and every application is backed by *experienced technical service.*

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testing procedures, testing evaluations, bearing design, and a number of graphs showing load *vs.* deflection for different diameter balls made of various plastics. $4.75. 115 pages. *Kaydon Engineering Corp., McCracken St., Muskegon, Mich.*

Epoxy pastes. Bulletin describes epoxy pastes used as patching compounds, filleting compounds, and sealers, and for making tools and fixtures. Properties, advantages, and suggested applications are given. 2 pages. *Furane Plastics Inc., 4516 Brazil St., Los Angeles 39, Calif.*

Reinforced plastics. Mechanical, electrical, and chemical properties of fibrous glass-reinforced plastics are described in this catalog. Molding processes, fabrication operations, and typical end products are also discussed. 16 pages. *Molded Fiber Glass Co., 4403 Benefit Ave., Ashtabula, Ohio.*

Precision filing. Bulletin 356 describes a line of hand files and illustrates the techniques of many hand filing operations necessary to insure accuracy of small production parts. Specifications are given. 8 pages. *Grobet File Co. of America, Inc., Carlstadt, N. J.*

Colorants. Heat stability, light stability, relative strength, and alkali resistance characteristics of a range of stir-in color pastes for vinyl plastisol compounds are presented in revised Technical Bulletin 140. Over 50 colorants are covered. Methods used in determining the characteristics are listed and described. Price list is included. 8 pages. *Claremont Pigment Dispersion Corp., 110 Wallabout St., Brooklyn 11, N. Y.*

Plastics facts. "Plastics Manual and Catalog" is a guide for working in plastics and presents information on materials, equipment, and supplies. The greater portion of the catalog's more than 100 pages deals with the various plastics formulations, their uses, methods of fabrication, end products, etc.; however, brief descriptions of their origins, lists of educational facilities, prices, and specifications for many products are also given. Sample pieces of various plastics are pasted on pages alongside their descriptions. *Fry Plastics Co., 7826 S. Vermont Ave., Los Angeles, Calif.*

Plastics in the home. Booklet outlines some of the major current applications for plastics in the home building industry. Areas covered include: plastics for foundations (vapor barriers, material covers, rain and wind shields, etc.); plastics for framing (thermal insulation, weather stripping); plastics for finishing (paints, varnishes, luminous ceilings, wall tile and coverings, flooring); plastics for built-in equipment (molded drawers, laminated panels and surfaces, reinforced structures, upholstery); and plastics for mechanical equipment (wire insulation, lighting fixtures, plumbing). 16 pages. *Bakelite Co., a Div. of Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y.*

Cementable Teflon. Catalog AD 158 gives specifications and properties of cementable Teflon tape available in thicknesses as low as 0.005 in. for use as linings for conveyor guide rails, hoppers, and other work surfaces handling corrosive materials. 2 pages. *The Garlock Packing Co., Plastics Div., P. O. Box 93, Camden 1, N. J.*

Silicone. Bulletins Nos. 22-26 describe how the use of a silicone product in various applications helped to solve design problems. Technical data, descriptions of various compounds, and end-use applications are presented. 2 pages each. *Dow Corning Corp., Midland, Mich.*

Heating cylinders. Booklet describes a line of heating cylinders for injection molding machines, how they are made, installed, and used, and points out their advantages. 32 pages. *Injection Molders Supply Co., 3514 Lee Rd., Cleveland 20, Ohio.*

Program kits. "Process Analysis and Control," second in a series of kits designed for presentation to an audience by any qualified individual in the field of engineering, contains a speaker's manuscript, visual aids (slide films), and up to 25 free copies of the program for distribution to the audience. It requires 45 minutes presentation time. There is no charge for the use of the kits with the exception of return postage and insurance on the slides. Details can be obtained from *National Program Committee, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 38, Mich.*

Phenolic. Catalog C-56 gives properties, grades available, design ordering information, gear information, horsepower ratings, and standard forms and sizes of various gears and machine parts molded of phenolic. 15 pages. *Continental-Diamond Fibre Div., The Budd Co., Inc., Newark, Del.*

Pipe and fittings. Two types of unplasticized polyvinyl chloride pipe and fittings (normal-impact and high-impact grades) are described in new product bulletin. General descriptions, advantages, specifications, properties, and installation instructions are given. 6 pages. *Alloy Tube Div., The Carpenter Steel Co., Union, N. J.*

Temperature controls. Condensed catalog describes a line of temperature controls and allied equipment for industrial heating and refrigeration applications ranging from −30 to +1200° F. Prices are included. 8 pages. *The Partlow Corp., 2 Campion Rd., New Hartford, N. Y.*

Cyclohexanone. Technical bulletin I-19 describes physical and chemical properties, and gives principal reactions of cyclohexanone, a chemical used as a plasticizer and in printing inks, adhesives, etc. A 178-item bibliography is included. 32 pages. *National Aniline Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.*

Rigid vinyl. The use of two rigid unplasticized polyvinyl chloride compounds in the industrial piping field, typical physical properties, and chemical immersion re-

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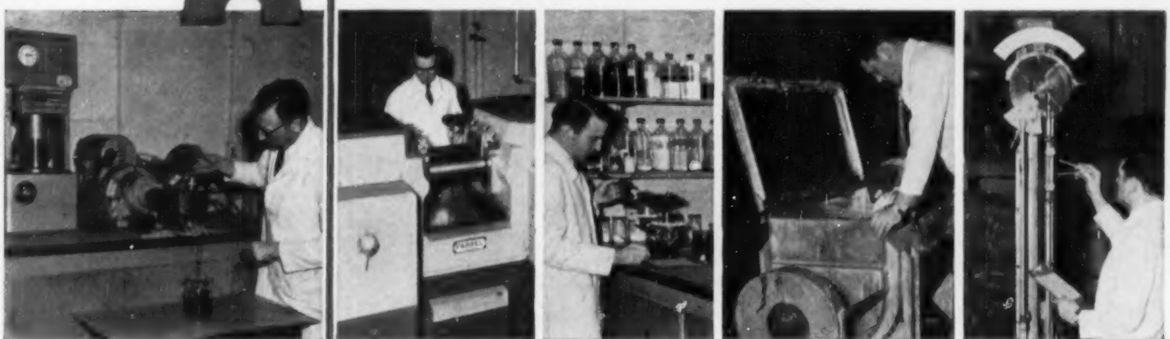

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Because they're saving money. Our processed vinyl and polyethylene DO cost less, but at the same time, precise laboratory control assures a product of the highest quality. Working with modern methods and machines, we are able to fill your raw material orders to EXACT specifications, at definite savings to you. HOW?

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sults are described in a technical bulletin. 8 pages. *B. F. Goodrich Chemical Co., 446 Rose Bldg., Cleveland 15, Ohio.*

Tracing. Folder describes operating principles, advantages, and specifications of a line of tracing equipment used to reproduce intricate forms in metal (such as molds). The equipment is said to be easily attached to standard milling equipment. 4 pages. *Pratt & Whitney Co., Inc., West Hartford 1, Conn.*

Antioxidant. Technical Bulletin L-18 gives physical and psysiological properties, storage and handling information, availability, and suggested uses for an antioxidant used in odorless paint, enamels, varnishes, pigment dispersions, inks, baking finishes, and hot melts and dips. 4 pages. *National Aniline Div., Allied Chemical & Dye Corp., 40 Rector St., New York, N. Y.*

Slitter and rewinder. Bulletin covers slitters and rewinders (in 40-, 50-, 60-, and 72-in. sizes) for use by converters of rigid or flexible plastics, paper and paper board, rubber calendered stock, etc. Specifications, characteristics, advantages, etc., are given. 4 pages. *Hobbs Mfg. Co., Salisbury St., Worcester, Mass.*

Epoxy tooling. The advantages offered by tooling compounds made of epoxy resins are described in a folder which also lists 39 types of plastics tools. *Bakelite Co., a Div. of Union Carbide and Carbon Chemicals Corp., 260 Madison Ave., New York, N. Y.*

Dicing cutters. Index No. App. 213 describes a line of cutters designed for producing pellets of plastic or rubber from material extruded or rolled in sheet form. Principles of operation, types of knives available, characteristics, and specifications are discussed. 4 pages. *Taylor, Stiles & Co., Riegelsville, New Jersey.*

Plastics coatings. Technical report describes laboratory tests on toxicity, chemical resistance (alkali, detergent, acid), stain resistance, adhesion, and flexibility of a plastisol coating. 3 pages. *Reynolds Chemical Products Co., 1200 N. Main St., Ann Arbor, Mich.*

Injection molding. Catalog No. 256 describes facilities, services, equipment, and typical products of an injection molding plant. 12 pages. *Wolverine Plastics, Inc., Milan, Mich.*

Automation. Brochure summarizes the results of a recent survey conducted by the American Society of Tool Engineers on the effects and future of automation. Many of the nation's industries are covered, in plants of all sizes, in every geographical region of the United States. Charts give interesting statistics on present and projected use of automation in industry. 12 pages. One copy free to the executive officer of a company on letterhead request. Additional copies $5.00 each. *Automation Survey, American Society of Tool Engineers, 10700 Puritan Ave., Detroit, Mich.*

Testing instruments. Leaflet P-560 contains brief descriptions of 31 instruments used for making physical tests on plastics, paper, textiles, light metals, and other materials. 4 pages. *Thwing-Albert Instrument Co., Penn St., Philadelphia 44, Pa.*

Industrial fans. A line of industrial fans designed to handle corrosive and explosive fumes, high temperatures and humidity, abrasive dusts, and dirt-laden air in plastics processing and other plants is described in bulletin 620. Information on construction, accessories, bearing assemblies, and performance of five fan sizes is included. 6 pages. *Propellair Div., Robbins & Meyers, Inc., Springfield, Ohio.*

Epoxies. General descriptions, properties, curing information, and uses of epoxy hardeners in laminating, adhesive, and repair applications are discussed in a technical data bulletin. Charts and graphs give such data as solvent resistance, tensile strength versus temperature, flexural strength versus temperature, and compressive strength versus temperature for a number of laminates using these epoxy hardeners. 17 pages. *Applied Plastics Co., 130 Penn St., El Segundo, Calif.*

Acrylic. Booklet describes acrylic laminates for room dividers, ceiling panels, doors, windows, walls, screens, home accessories, etc. Available patterns are described; sample pieces of acrylic are pasted to pages of booklet. Price list and size chart are given. 36 pages. *Wasco Products, Inc., Cambridge 38, Mass.*

Fluid power. Non-technical booklet explains what fluid power means, how it works, and gives its uses in plastics molding machines and other industrial equipment. 20 pages. *National Fluid Power Association, 1618 Orrington Ave., Evanston, Ill.*

Teflon. Catalog describes properties, specifications, and fabrication of Teflon rods, sheets, tapes, and tubes. 15 pages. *Continental-Diamond Fibre Div., The Budd Co., Inc., Newark, Del.*

Nitroparaffin. Case histories on the use of nitroparaffins and derivatives in solving processing problems in the plastics and other industries are presented in "Nitroparaffin Symposium." Some of the subjects covered are: The Nitroparaffins as Solvents for Technical Coatings, Nitroparaffin Chemistry, and The Future of Nitroparaffins. 48 pages. *Commercial Solvents Corp., 260 Madison Ave., New York 16, N. Y.*

Foundry molds and cores. Resins, sands, sand-coating techniques, and the production of blown shell molds and shell cores are discussed in bulletin No. 1022. A section covers trouble-shooting shell mold and core production. 16 pages. *Monsanto Chemical Co., Plastics Div., Springfield, Mass.*

Extruder cylinders. Bulletin describes a line of bimetallic extruder cylinders used in the plastics and rubber industries. Characteristics, properties, speci-

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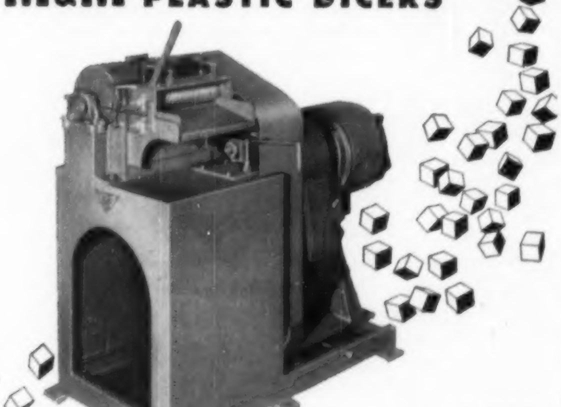

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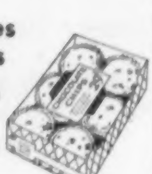

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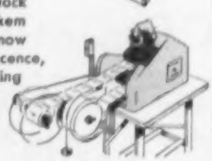

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fications, machinability, etc., are covered in chart form. 15 pages. *Industrial Research Laboratories, 961 E. Slauson Ave., Los Angeles 11, Calif.*

Vibratory equipment. Set of bulletins describe new electro-permanent magnetic vibratory equipment used to feed bulk materials into enclosed furnaces, batch weighers, packaging machinery, etc., in the plastics and other industries. Specifications, characteristics, advantages, etc., are given. *Eriez Mfg. Co., Erie, Pa.*

Materials handling. Six case histories are given to show how material handling methods were improved through the use of lightweight vulcanized fibre containers. 12 pages. *National Vulcanized Fibre Co., 1056 Beach St., Wilmington 99, Del.*

Plastic machinery. Bulletin describes a line of machinery used in the plastics industry, including automatic embossing machines, polishing units for finishing calendered vinyl sheeting, knife coaters, two-color production print machines, package rewind units, etc. Specifications, advantages, etc., are given. 22 pages. *Liberty Machine Co., Inc., 275 Fourth Ave., Paterson 4, N. J.*

Acetophenone. Technical bulletin F-6970 gives information on properties, specifications, constant boiling mixtures, and solubilities of acetophenone, a simple aromatic ketone used in the manufacture of certain drugs and resins. Typical reactions are given. 8 pages. *Carbide and Carbon Chemical Co., a Div. of Union Carbide and Carbon Chemicals Corp., 30 E. 42 St., New York 17, N. Y.*

Hot spray painting. Three information folders describe a line of hot spray equipment and paint pumps. Advantages, characteristics, methods of application, and technical data are included. *The DeVilbiss Co., Toledo 1, Ohio.*

Marking machine. Brochure describes a high-speed unit for marking cylindrical or cone-shaped objects used in the plastics and other industries. Principles of operation, specifications, advantages, and ordering information are included. 4 pages. *Jas. H. Matthews & Co., Inc., 3942 Forbes St., Pittsburgh 13, Pa.*

Box sealing. Booklet entitled "How to Seal Corrugated Shipping Boxes" outlines both hand and automatic sealing procedures, as well as application of adhesives, gummed and pressure-sensitive tapes, stitches, staples, and steel bands. 24 pages. *Hinde & Dauch, Sandusky, Ohio.*

Standard test methods. Twenty-one standard test methods, as well as alternate methods, which have been developed to determine the product quality desired to meet end-use requirements involving vinyl- and pyroxylin-coated fabrics and all-plastic sheeting are described in this booklet. Also included is a section on customs and terminology used in the industry. 34 pages. *Vinyl Fabrics Institute, 65 E. 55 St., New York 22, N. Y.*

Vacuum metallizing. The history, technique, and process of vaporizing aluminum for vacuum metallizing of plastics and other materials, is described in a booklet entitled "Micro-Wire." Price list for stranded tungsten wire used in the operation is included. 12 pages. *Micro-Wire Stranding Co., 252 Chestnut St., Passaic, N. J.*

Safety data. The two latest additions to a series of safety data sheets list properties and give essential information for the safe handling and use of arsenic trioxide (SD-60) and phthalic anhydride (SD-61). Included is material on shipping containers, storage, waste disposal, and health hazards and their control. 16 pages each. 30¢ each. *Manufacturing Chemists' Association, Inc., 1625 Eye St., N. W. Washington 6, D. C.*

Plasticizer. Booklet describes a distilled butyl octyl phthalate for use as a substitute for dibutyl phthalate in cellulose nitrate lacquers. Specifications, properties, compatibility of this plasticizer

with various resins, and several military specifications are included. 8 pages. *Eastman Chemical Products, Inc., Kingsport, Tenn.*

Vinyl sheet. Characteristics, advantages, and typical applications of rigid vinyl sheet are described in leaflet. *BX Plastics Ltd., Higham Station Ave., Chingford, London E. 4, England.*

Laminates. Catalog describes a line of industrial and decorative laminates used for table-tops, counters, bars, furniture, etc. Also discussed are binders, tolerances, fabricating qualities, types available, etc. 8 pages. *Farley & Loetscher Mfg. Co., Plastics Div., Dubuque, Iowa.*

Rolls. A set of Industrial Engineering Reports presents information intended to assist in the design, selection, and use of rolls for specific plant applications in the plastics, textile, rubber, paper, and other industries. Some of the topics covered include: Roll Body Deflections; Roll Shaft Breakage; Design and Deflection in Roll Shafts; Roll Shaft Fatigue Failure; Roll Surfaces Finishes; Thickness of Rubber Rolls. 9 reports, 2 pages each. *Rodney Hunt Machine Co., Orange, Mass.*

Vinyl extrusion compound. Advantages, limitations, processing information, and physical and chemical properties of a new type of rigid vinyl extrusion compound are outlined in a technical brochure. 12 pages. *The General Tire & Rubber Co., Chemical Div., Akron, Ohio.*

Where credit is due

In the article "Israel: study in versatility," published in our May issue, the following statement was made on page 102: "Carmit Ltd. manufactures three Argus stabilizers under a license arrangement." This statement should read as follows: "Carmit Ltd. manufactures a satisfactory grade of calcium stearate and Samuel Rohald manufactures three Argus stabilizers under license from the Brooklyn firm."

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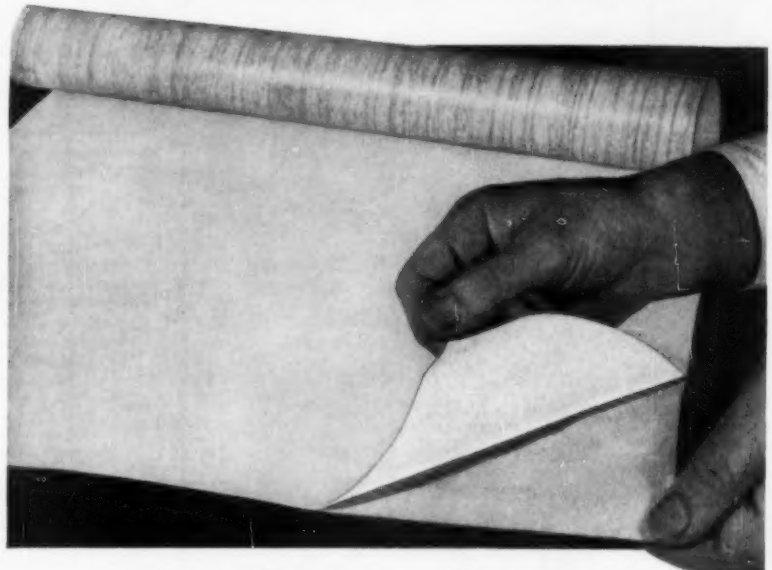

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Plastics

Production and sales figures in 1000 pounds* for March and April 1956

Materials	*Total p'd'n first 4 mos. of 1956‡*	*Total sales first 4 mos. of 1956‡*
Cellulose plastics:[a]		
Cellulose acetate and mixed ester sheet, under 0.003 gage	6,554	6,567
Sheets, 0.003 gage and over	5,557	5,143
All other sheets, rods, tubes	2,725	2,570
Molding, extrusion materials	29,053	28,527
Nitrocellulose sheets, rods, tubes	2,030	1,939
Other cellulose plastics	1,965	1,773
Phenolic and other tar-acid resins:		
Molding materials[a]	80,954	68,895
Bonding and adhesive resins for:		
Laminating (except plywood)	22,493	15,739
Coated and bonded abrasives	5,746	5,711
Friction materials (brake linings, clutch facings, etc.)	7,431	6,606
Thermal insulation	19,273	18,718
Plywood	15,326	12,268
All other bonding uses	10,925	10,819
Protective-coating resins	10,619	9,296
Resins for all other uses	10,799	9,321
Urea and melamine resins:		
Textile-treating resins	17,738	15,089
Paper-treating resins	8,442	7,902
Bonding and adhesive resins for:		
Plywood	35,502	32,895
All other bonding and adhesive uses, including laminating	9,353	7,798
Protective-coating resins	13,092	9,291
Resins for all other uses, including molding	30,403	27,692
Styrene resins:		
Molding materials[a]	145,927	142,583
Protective-coating resins	34,023	32,418
Resins for all other uses	33,558	34,766
Vinyl resins, total[b]	260,659	240.789
Polyvinyl chloride and copolymer resins (50% or more polyvinyl chloride) for:		
Film (resin content)		26,980
Sheeting (resin content)		20,178
Molding and extrusion (resin content)		65,876
Textile and paper treating and coating (resin content)[c]		20,971
Flooring (resin content)		19,585
Protective coatings (resin content)		8,698
All other uses (resin content)		25,875
All other vinyl resins for:		
Adhesives (resin content)		12,325
All other uses (resin content)		40,300
Coumarone-indene and petroleum polymer resin:	82,279	80,507
Polyester resins:	22,717	19,422
Polyethylene resins:	166,909	159,416
Miscellaneous:		
Molding materials[a, d]	14,799	12,985
Protective-coating resins[e]	2,901	1,612
Resins for all other uses[f]	39,949	36,698

[a] Dry basis designated unless otherwise specified.
† Revised. ‡ Partially estimated.
[c] Includes fillers, plasticizers, and extenders. [b] Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total production

Production

From statistics compiled by
the U. S. Tariff Commission

March†		April‡	
Production	Sales	Production	Sales
1,901	1,790	1,545	1,660
1,639	1,535	1,398	1,265
756	736†	664	625
8,007	8,078	7,376	7,077
501	487	513	471
585†	639†	429	356
20,351	17,024	20,609	17,616
6,218	4,454	5,071	3,458
1,318	1,388	1,509	1,547
1,936	1,735	1,663	1,644
4,711	4,668	4,743	4,479
4,060	3,255	3,747	2,933
2,772	2,783	2,835	2,957
2,578	2,347	2,674	2,199
2,569	2,254†	2,629	2,074
4,081	2,633	3,887	2,742
1,447	1,873	2,321	2,094
9,239	8,172	8,169	8,364
2,019	1,881	1,878	1,666
2,986	2,032	3,709	2,535
8,375	7,454	7,104	5,779
34,869	36,169	40,172	40,585
8,825	8,475	7,699	7,781
8,403	8,649	8,639	9,170
66,675	60,222	65,487	59,986
	7,388		6,247
	5,280		4,674
	16,965		15,560
	4,962		4,646
	5,016		4,494
	2,274		2,344
	5,811		7,295
	3,162		3,114
	9,364		11,612
22,061	21,302	20,344	20,170
5,986	5,045†	5,855	5,778
40,567	42,187	42,205	38,783
3,922	3,443	3,372	2,822
902	416	697	389
9,906	9,374	10,530	9,482

are given. [c] Includes data for spreader and calendering-type resins. [d] Includes data for acrylic, nylon, and other molding materials. [e] Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins. [f] Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.

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Model 6002 Dual

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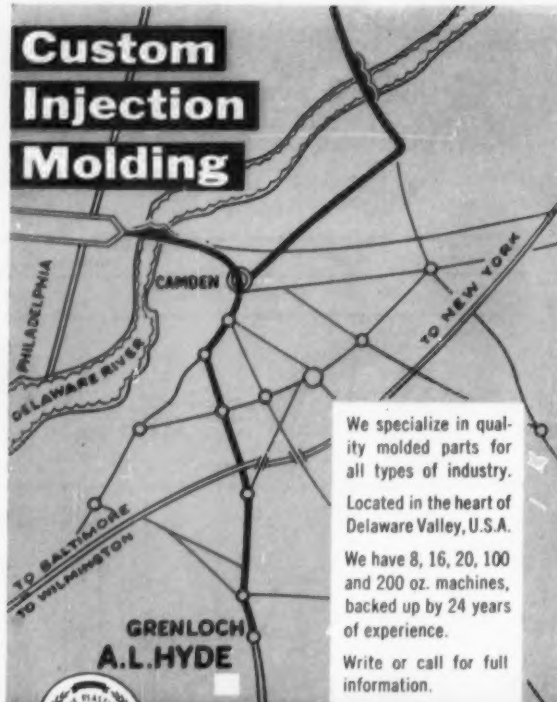

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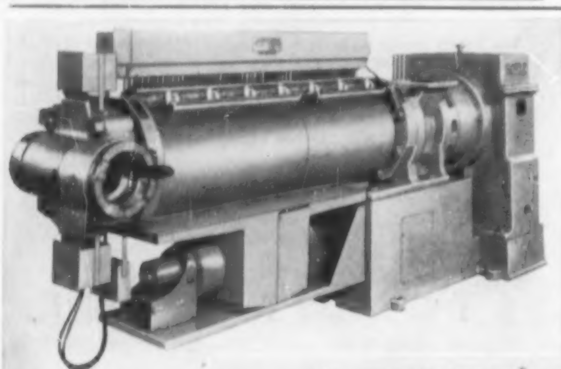

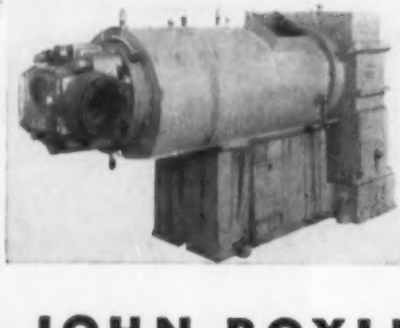

8½" Spirod extruder with side delivery head for jacketing. Up-graded from circulating type shown to the right.

Yes, it can be—and is being—done. And Royle's traditional approach to extruder development, the retention of features that have stood the test of time, makes it possible. The one-piece cylinder with built-in hopper is replaced by a separate cast steel hopper section, a cast steel cylinder with deep grooves that create fin-like separations for the rod type heating elements and the selective evaporative cooling equipment. Head and stock screw, as usual, are designed for process requirements.

If you are operating an older type Royle extruder you should investigate up-grading to Spirod—the electrically heated extruder with high velocity evaporative cooling—for maximum efficiency in controlled operating temperatures.

Write for Bulletin # 463

JOHN ROYLE & SONS — ROYLE PATERSON N. J.

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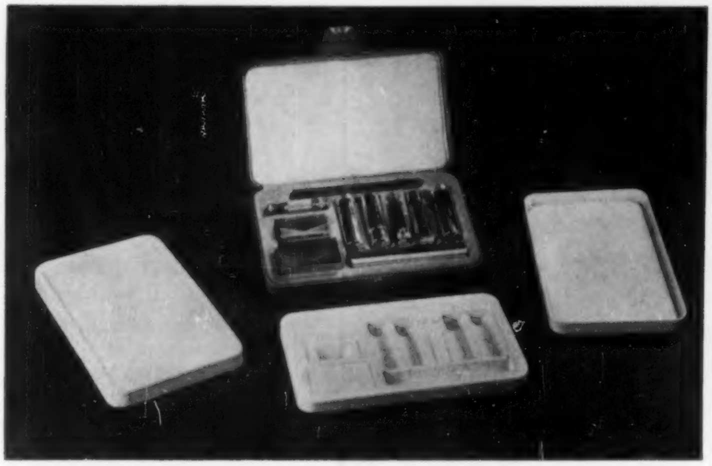


Lid, base, and contoured insert (foreground) for toilet kit are vacuum formed of high-impact styrene. When assembled into kit (top), lid and base are covered with leather and insert is flocked

Toilet kit formed of styrene sheet

Having many times over proved their adaptability to the economical production of functional, sales-appealing packages, plastics sheet forming techniques continue to extend their influence in new directions in the lucrative packaging industry.

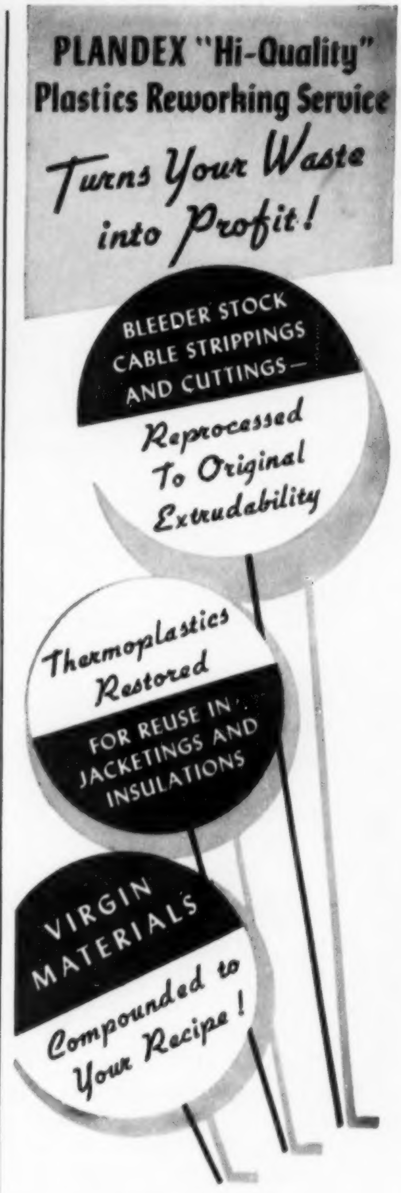
Latest area to feel the impact of developments in sheet thermoforming is that segment of the leather goods field which includes toilet kits, military sets, electric shaver cases, overnight cases, and similar types of luxury packages. Traditionally, these units are produced by first turning out the desired shape in cardboard, papier mâché, metal, or wood, and then covering this basic form with natural leather or embossed plastic sheeting. When working with these conventional materials, however, in those instances where other than simple shapes were involved, the cost of the end-product had to be raised to cover the additional expensive fabrication steps. The physical properties of the various materials—lack of strength and rigidity in some cases and lack of flexibility in others—also placed limitations on package design potential.

To overcome these limitations, a number of package designers have been giving consideration to the possibility of vacuum forming plastics sheet to serve as the supporting sections of such cases. One successful example now on the market is a case for a toilet kit in which the three major components are vacuum formed of high-impact styrene sheet—the lid and base of the unit in 80-gage material and a contoured platform insert in 40-gage sheeting. The platform insert, in particular, incorporating recessed cavities for comb, shaving tackle, toothbrush, nail clipper, etc., would have been prohibitive in cost to produce in most conventional materials.

The vacuum formed lid and base are covered with saddle leather and hinged together; the platform insert, which fits into the base, is flocked to achieve a soft, velvety effect.

In addition to the adaptability of the vacuum formed components to complex, yet compact, design, the use of high-impact styrene sheet provides a rigid body for the case that is tough enough to withstand the hard use to which a toilet kit is normally subjected. Also, the styrene body will not warp or distort and its light weight is an ideal advantage when the kit is to be used while travelling.

Credits: Travel-Pak "President" formed for Cold Forming Corp., Waterbury, Conn., by The Valley-National Corp., Milldale, Conn.; Styron sheet supplied by Dow Chemical Co.



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a *BIG* market for plastics . . . the packaging field

"Big Market," is right! The men who select the materials used to package the output of American industries control a market that will exceed the 10 billion dollar mark this year.

This rich market is composed of about forty industries. It includes manufacturers and packagers of such products as foods, cosmetics, chemicals, drugs, candies and tobacco products. In all these highly competitive industries frequent packaging changes are the order of the day. Factors ranging from fascinating sales appeal to plain hard costs influence the men who make the packaging decisions. Consequently, no one type of packaging material (glass, metal, paper or fabric) ever has assurance that it won't be supplanted by another.

And now plastics have entered the arena as directly competitive materials for packaging. In just the last few years they have come to play an increasingly important role—and often at the expense of older "traditional" materials.

Especially noteworthy is the fact that plastics can be used in the manufacture of almost every basic package type: box, bag, bottle, drum, jar, vial or collapsible tube!

Right now this frontal invasion of the packaging field by alert plastics manufacturers, molders, laminators and fabricators has just begun. And their chief sales tools are the two publications which reach the men who make packaging decisions—MODERN PACKAGING Magazine, issued monthly, and the annual MODERN PACKAGING ENCYCLOPEDIA ISSUE.

Details about the Market

Additional data on using these media to help expand your sales to the packaging market are contained in the booklet "The Packaging Field and How to Reach It." Write for your copy.

MODERN PACKAGING

A BRESKIN PUBLICATION

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Acrylic light fixture

By taking advantage of the optical properties inherent in molded acrylic, a new fluorescent lighting fixture is designed to provide prismatic light control in all directions while eliminating glare from the direct viewing zone.

To provide this high level of lighting efficiency, the acrylic enclosure which fits over the fluorescent lights is precision molded with a series of prismatic cones and parallel refracting prisms. Each indentation in the outer surface of the enclosure represents a tiny individual conical lens which refracts and transmits light equally in all directions.

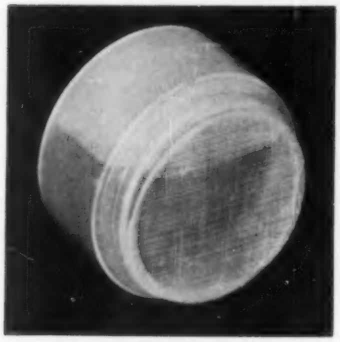
Since the acrylic enclosure is also light in weight, shatterproof, and easy to clean, it can be used in conjunction with a lighter, more compact steel fixture frame.

The complete ceiling-mounted fixture is available in 4- and 8-ft. lengths. Each 4-ft. hinged section incorporates two of the 24-in. acrylic elements. The edges of the elements fit into grooves in a light steel door which is hinged to either side of the fixture. To facilitate tube replacement and maintenance, this door can be completely removed by lifting it out of the hinge grooves.

Other advantages of the molded acrylic enclosure include excellent dimensional stability, freedom from discoloration, and a sparkling surface texture.

Credits: Realite fixtures manufactured by Holophane Co., New York, N. Y.; Plexiglas acrylic supplied by Rohm & Haas Co., Philadelphia, Pa.

Acrylic enclosure for lighting fixture gives prismatic light control



Container with woven polyethylene-coated closure securely heat-sealed directly to mouth

Threadless closure

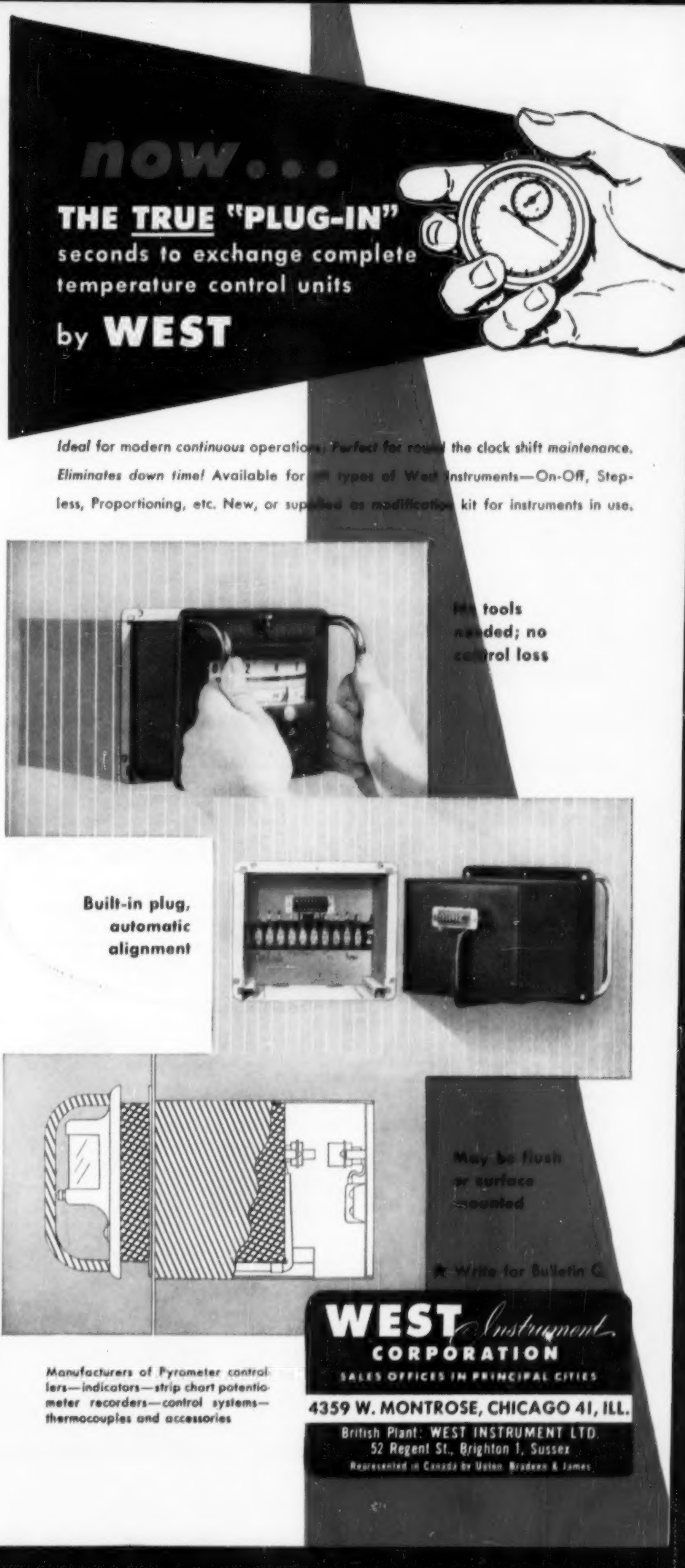
The exceptional strength of a plastics-to-plastics bond is the key to the design of a new type of threadless closure for polyethylene containers. Consisting of a barrier material, such as cloth, foil, or paper, coated with polyethylene, the closure can be heat-sealed directly to the mouth of the container to provide completely leakproof service. Since the heat-sealed closure will not tear evenly, any attempt to break or remove it will be immediately noticed, thus preventing tampering.

The seal may be preprinted and is available either in clear transparent (so that contents can be seen) or in translucent or opaque colors, depending upon the barrier material used.

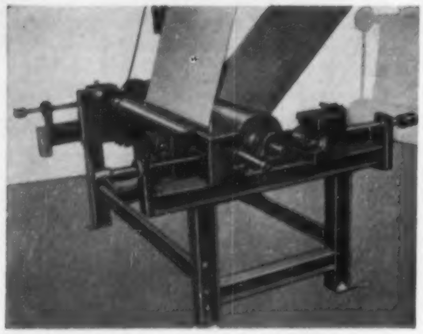
Although no high-speed machinery for applying the seal is currently available, the manufacturers believe that there are several machines that can be adapted for this purpose. For large containers, however, which are not filled on high-speed lines, hand application of the seal is practical. Because no threads are required, the closures can be made in such shapes as square, rectangular, oval, and triangular for a variety of special uses.

The closures cost no more than one-tenth of a cent each and, in some applications, completely eliminate the need for additional caps.

Credit: Polyethylene-coated closure is produced by Plax Corp., Hartford, Conn.



Liberty introduces a NEW two-color gravure press



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The Liberty press precision-prints in two colors, with exact registration assured by three easily-made roller adjustments: *in-and-out, up-and-down,* and *sideways.* The press can be readily converted from gravure to aniline printing.

With all these advantages, the Liberty two-color press is yours at a low, sensible price. For additional information, write Liberty Machine Co., 275 Fourth Avenue, Paterson 4, New Jersey, or phone SHerwood 2-5565.

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If you're working with vinyl—rigid or flexible—then this newest Wilross Products data is must reading. It presents completely up-dated ideas and applications on a line of 16 different adhesives to handle the majority of vinyl fabricating and laminating problems.

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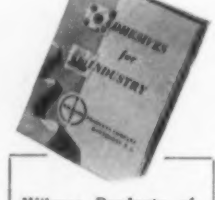
Why not write today for your free copy. Tell us about your problem and include any pertinent information you feel will help us solve it.



Wilross Products offers a comprehensive data file on a complete line of adhesives. If you're not working with vinyl, but have a bonding problem, write requesting your copy of "Adhesives For Industry."

WILROSS PRODUCTS COMPANY

20 Fourth Ave. • Hawthorne, New Jersey

Reinforced molding

(From pp. 91-96)

years therefore will probably depend more on empirical design and end-use testing of prototypes, rather than on direct use of precise numerical values of physical properties.

Automobile applications

Once a part has been successfully redesigned, it has generally been found that the new premix application will either compete favorably with relatively low-cost metals by cutting down on fabrication and assembly costs, or will contribute design and property advantages that make it worth additional costs.

As such, the reinforced polyester compounds have proved especially attractive to a number of large industrial end-users—the largest of which has thus far been the automobile industry.

Chrysler, who pioneered the use of the material in the industry, already numbers among its molded premix applications auto heater housings, air ducts, air-conditioning components, blower scrolls, plenums, kick and scuff panels, seat sides, and arm rest foundations. (Chrysler parts are being molded by Woodall Industries; by Fabricon Products Div., Eagle-Pitcher Co., River Rouge, Mich.; and by Industrial Products Div., General Tire and Rubber Co.) The '56 Pontiac has an air conditioner housing molded of reinforced polyester and Buick expects to have one in the '57 models. Both Ford and Mercury use window strips (garnish moldings) molded of the material in their station wagons and the Checker Cab Mfg. Corp. has a number of models on the market in which not only the garnish moldings but the base of the folding seats in the rear of the cab are molded of reinforced polyester. Chevrolet's Corvette also uses molded premix heater housings and other components.

The emphasis on molded automotive heater and air conditioning units points to this type of application as one that is rapidly developing into a standard market for the reinforced polyester compounds. In addition to the cost

savings made possible by more compact design, the performance of the heater system is considerably improved. The reinforced polyester is a better insulator than metal; hence a 10° F. increase in the temperature of the hot air being delivered was made possible. The use of plastic also eliminates the need for additional sound-deadening treatments and the extra finishing which is necessary on metal.

Expectations are that, by 1957, most major automobile manufacturers will have extended their use of the reinforced polyester molding compounds. One of the brightest spots in the picture has been the recent development of molded door liners for the Lincoln Continental. The glass-reinforced liner, which will be upholstered in vinyl, is one of the largest pieces thus far made for the automobile industry.

It does not seem likely at the present time that molded premix automobile applications will get any larger than the size of the door liner. Large body components, such as are used in the Corvette, will probably continue to be matched metal molded from cloth or mat materials. The interest of automobile designers seems to center rather on the possibility of molding some of the smaller exterior body parts, e.g. tail fins, front fenders, etc., of the premix materials and adapting such parts to a basic metal body. Thus, the expensive tooling costs required for a metal body can be amortized over a longer period of time while the molded parts (involving much lower tooling costs) can be economically redesigned annually.

Cost advantages

Andre M. Hansen, project engineer, Chrysler Corp., cites some of the economic advantages which have promoted the use of reinforced polyester compounds in the automobile field as follows: 1) the basic cost of matched metal molds used for premix molding generally are less than a set of comparable steel forming tools. Moreover, in a set of steel forming tools, there are generally several types of tools required—blanking die, forming die, flang-

(*To page 198*)

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(*Above*) One of the calendering machines at Flexton Corporation, Conshohocken, Pa. and (*right*) some of the tramp metal detected.

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—reports head of vinyl plastics firm

In its manufacture of vinyl plastic fabrics—both reprocessed and vinyl film and sheeting—the Flexton Corporation uses two RCA Metal Detectors to keep tramp metal from entering their calenders. Says Mr. Frank Weiswasser, Vice-President, "I do not know what we would do without this equipment. Should foreign matter get into our calenders it could damage them to such an extent our production would be at a standstill for weeks. Over the years our RCA Metal Detectors have saved us tens of thousands of dollars in detecting foreign matter in our raw materials. We feel the Detectors are cheap at any price."

The RCA Metal Detector is completely automatic and can be readily installed by your own personnel. It can be set so that it detects tramp metal which might damage the equipment and delay production, while allowing coloring metals to pass. Both magnetic and non-magnetic metals are detected—even nickel, lead, tin, brass and stainless steel. When metal is detected, this RCA device stops the machine and/or sounds an alarm.

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U.S.I. POLYETHYLENE PROCESSING TIPS

Vol. 1, No. 4

Molders Can Minimize Shrinkage

Shrinkage of injection molded items is often a troublesome problem for molders. In closures, and in components which are to become part of an assembly, excessive shinkage can be a major cause of rejects. The growing use of polyethylene for such parts has sparked molder interest in shrinkage control on items made from polyethylene resins.

While a certain amount of shrinkage is inherent in any process that involves cooling of a material from elevated temperatures, it is possible for injection molders to minimize the condition to acceptable levels.

In polyethylene, such control may be achieved by the right choice of operating conditions and by selection of a resin with characteristics to fit them.

Lower Temperatures Key to Less Shrinkage

Since shrinkage is a natural result of cooling, a main avenue of attack on the problem is to mold at lower temperatures. Here are some procedures that tend to reduce shrinkage:

Reduce barrel temperature and run a cold mold.

Use high pressure and long inject time to pack the mold as much as possible, short of causing the item to stick.

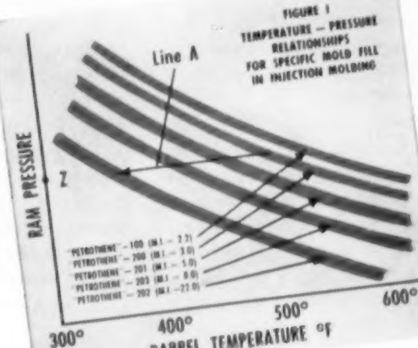
Allow longer dwell time. This helps to equalize temperatures throughout the mass so that cooling takes place at a uniform rate.

This point deserves further comment. Since the last material to flow into the mold is considerably hotter than the plastic at the extremity, a substantial temperature differential may still exist when the mold is opened. This uneven cooling results in non-uniform shrinkage which, in turn, causes the item to warp. Longer dwell time permits some equalization of this temperature difference and thereby keeps uniform the shrinkage that does occur. (The problem of warpage is discussed more fully in a previous issue of "Processing Tips". Write for a reprint if you missed it.)

High Melt Index Resins For Lower Molding Temperatures

Polyethylene resins with high melt indices can be a big factor in reducing shrinkage. In the first place, high melt index permits lower molding temperatures. This means less cooling, hence less shrinkage. At the same time, their higher flow characteristics permit tighter packing of the mold.

PETROTHENE 202 and 203 polyethylene resins are well suited to operating conditions for minimum shrinkage. The high melt indices of these resins permit reduction of injection temperatures by 70° to 130° for a given fill, cycle time and ram pressure. This is graphically illustrated by a set of curves for a particular mold:



Curves show how resins with high M.I. permit lower molding temperatures for a given pressure and fill. At pressure Z, a resin with comparatively low M.I., such as PETROTHENE 200, may require a barrel temperature of 500°F. Under the same conditions, PETROTHENE 203 requires 430°, PETROTHENE 202 only 370°.

Special Problem? Call on U.S.I.

In general, the suggestions outlined here will reduce shrinkage of molded polyethylene items. Some experimentation may be necessary, of course, to achieve a satisfactory result for your particular situation. In many cases, a switch to high-flow resins such as PETROTHENE 202 or 203, where these resins are satisfactory for the end-use, will permit operation at best conditions for minimum warp.

If the nature of your product creates an unusual problem, don't hesitate to call on U.S.I. for technical assistance. Well qualified Technical Service personnel stand ready to help you find a practical and economical solution.

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ing and piercing die, etc.; 2) the versatility of the molding process overcomes some limitations of steel drawing practice by permitting the molding of a single plastic piece which can take the place of several assembled formed metal pieces; 3) the versatility of design of the molded plastics parts many times permits the savings of production assembly costs.

The availability of low-cost sisal fibers as reinforcing materials has also helped in many instances to reduce the price differential between plastic and metal. Sisal is generally used for those parts which are not subjected to heavy loads. For moldings that require greater strength or for those applications where water absorption may be a factor, glass fibers are generally used.

And finally, the adaptability of the compounds to automatic, mass-production processes has resulted in considerable savings.

In the low-glass-content compounds (up to 15 to 20%), the material is generally in a putty-like, sticky form; in the high-glass-content materials (from 25 to 35%), it is loose and springy. Generally, the compounds are supplied in bulk form. For molding, a predetermined quantity is weighed out by hand and manually wadded together into a ball or other suitable shape. More recently, it has been found possible when working with the low-glass-content medium-impact materials to extrude the compound into a rope-like form that can be chopped off to the proper length—a technique that is ideally suited to the principles of automation. Thermaflow already supplies lengths of compound in rope-like form to molders; to facilitate handling even more, Glaskyd extrudes compound into the rope form and winds it onto a spool.

Flexfirm claims that by individually coating strands of fibrous glass roving with polyester resin, cutting them to controlled varying lengths, and then fluffing and separating them, the job of weighing a charge for a mold is simplified. The operator does not have to tear clumps apart; he simply shakes the needed amount of material into the weighing pan.

And in the offing are preform machines which will be able to handle the high-glass-content materials.

Electrical applications

Although the automotive field uses the largest poundage of material, the electrical industry far surpasses the auto makers in the number of applications for reinforced polyester compounds—and the potential is there for even greater expansion. According to Roger White of The Glastic Corp., the glass-reinforced polyester molding compounds can contribute the following advantages to an electrical application: 1) improved heat resistance, dimensional stability, and electrical stability; 2) excellent resistance to humidity (thereby helping to maintain dielectric strength and dimensional stability under humid conditions); 3) higher impact strength to guard against abuse during assembly or in the field; and 4) lower costs as a re-

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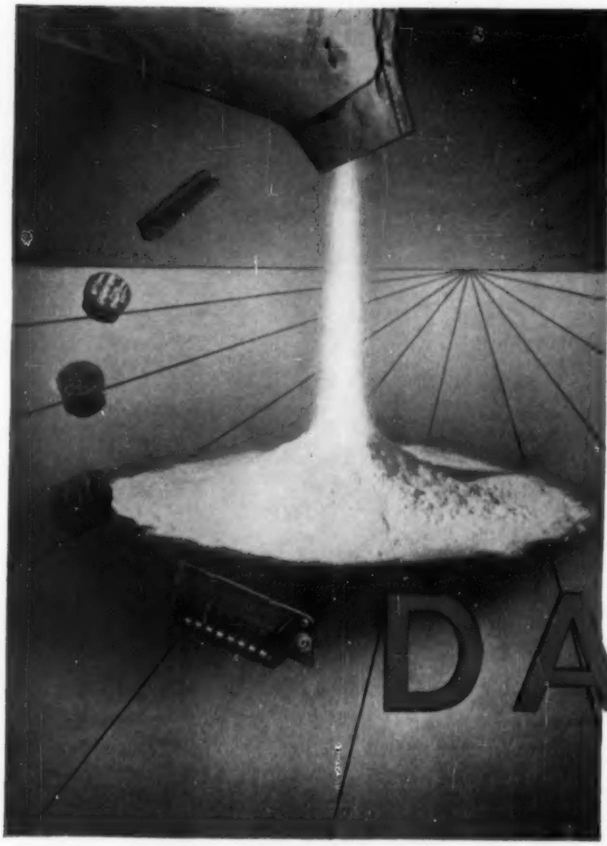

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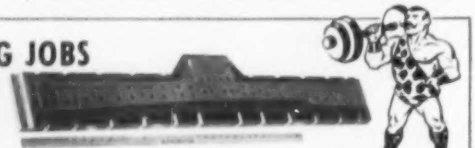
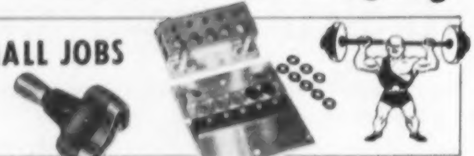


SMALL JOBS



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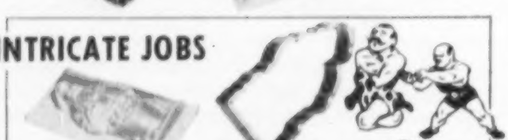

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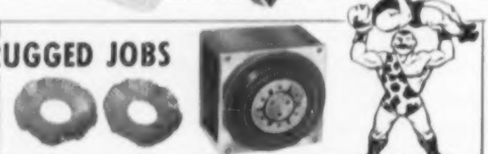

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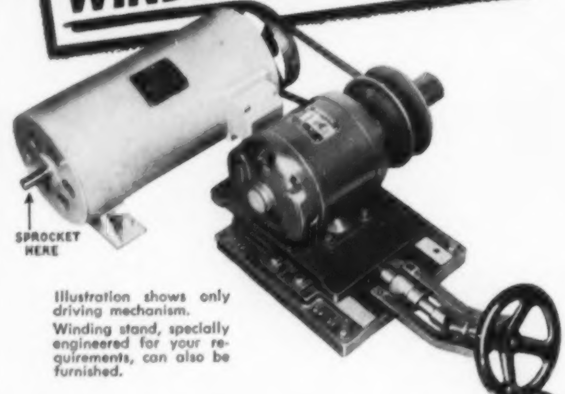

Illustration shows only driving mechanism. Winding stand, specially engineered for your requirements, can also be furnished.

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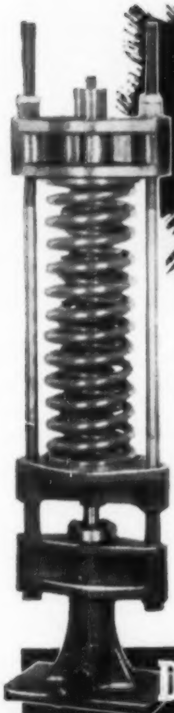

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sult of reductions in tool and piece costs.

Stand-off insulators, coil forms, brushholder insulator assemblies, connector arms, generator parts, electrical switches, support blocks, and other insulators of various types are already among the successful applications of the molding compounds. Case histories that illustrate the advantages of switching to reinforced polyester include:

1) A rear blow-out support in a circuit breaker (molded by The Glastic Corp.). Originally, the support—15 in. long by 6 in. wide by 6 in. deep and designed to support and insulate the arc chute assembly in an air-type circuit breaker—was assembled from seven pieces of machined canvas-reinforced phenolic and molded general-purpose phenolic, plus holding devices, such as screws, etc. By switching to a one-piece molded premix part, a 60% cost savings per part was effected because of reduced inventory, fabricating labor, and assembly labor.

2) A primary contact for a circuit breaker rated up to 600 amp., 600 v. (molded by Penn Plastics Co., Glenside, Pa., using material supplied by Thermaflow). Since bus bars can be molded into the piece, alignment problems were eliminated, assembly operations were cut down in cost, and 20 of the bolts used in the original assembly were eliminated. The strength of the molded material permits a thin cross section and compact shape.

3) An outlet box designed to protect electrical connections from moisture and contamination and prevent fire in the event of an electrical overload at the connections (molded by Porcelain Products, Inc., Findlay, Ohio, using premix material based on polyester resin supplied by Plaskon, Barrett Div., Allied Chemical and Dye, and Celanese Corp., and fibrous glass materials supplied by Owens-Corning and Libbey-Owens-Ford). Because of the reinforced plastic construction, the box is unaffected by moisture or corrosive atmospheres, making it ideal for locations where metal boxes would corrode. The rugged box will withstand high temperatures, will not warp, stretch, or distort, and will not deteriorate with age—yet it weighs much less than its metal equivalent. Molded-in knock-out sections are provided through which the wires pass; the clamps that hold the wires in place are also molded of premix materials.

Opening new markets

The reinforced polyester molding compounds have also started to move into other large-volume markets as well as into specialized applications.

In the appliance field, for example, molded glass-polyester materials are ideally suited, by virtue of their corrosion resistance, for use in automatic washers and dryers. Because of their high strength at low temperature, they are equally suitable in refrigerators and freezer cabinets. In the latter category, a number of manufacturers already have in production

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door latch mechanisms and support brackets based on the premix materials. As an example, Kelvinator Div., American Motors, Grand Rapids, Mich., now uses 25 different molded glass-polyester parts in 46 structural locations—with savings of up to 50% in production costs.

Tool handles, for which Plumb's famous F-55 hammer handle pointed the way, are also among potential large-volume product uses for the molding compounds. Plumb now reports on a series of electrode holders molded by Wagner Mfg. Co., Inc., for the welding industry, in which tip insulation, trigger insulation, and insulating handle are all molded of Plumb's polyester-glass materials. Since the tools are used close to a welding arc, the fact that the molded parts can withstand temperatures up to 700° F. strongly influenced the decision to use them. High impact strength, light weight, and the wide range of colors in which the compounds are available also contributed to the decision.

Other possibilities are opening for the compounds in such areas as housings for business machines (Camfield Mfg. Co., Grand Haven, Mich., already uses a combination of premix and preform molding for the housing of a Victor cash register); housings for home sanders, drills, etc.; gas meter housings; tote boxes and shipping containers; and photographic equipment.

The success of a valve body based on Thermaflow's material and designed by W. G. Rovang & Assoc., Inc., Portland, Ore., for use in the chemicals and pulp and paper industries has centered attention on the field of molded valves, pipe fittings, and filter plates. The Rovang valves can stand a wide range of acids and alkalies, great mechanical stresses, and wide extremes of temperature—yet they cost 60% less than stainless steel valves.

Even in the area of consumer products, the compounds are now being given top consideration. By using a better grade of compound and more expensive molds than are necessary for some of the products thus far described, the molded parts can be given an attractive, consumer-appealing finish. Admiral Corp. reportedly has in the works an attractive phonograph housing molded of a special polyester-sisal compound. And a number of manufacturers of air-conditioning units are considering the possibility of changing metal components over to the plastics.

Molding techniques

Although the applications described above cover widely separated fields, a number of problems in mold design and molding technique are common to many. While no hard-and-fast rules can be given to solve all these problems, some recommendations can be made which might facilitate a given job. Richard Doyne, president of Thermaflow Chemical Corp., supplied the suggestions on molding techniques which comprise the remainder of this article.

The reinforced polyester molding compounds are almost invariably compression molded at very low pressures, from 250 p.s.i. up to 1000 p.s.i. for large parts. This means that back-pressure during flow is not created to the degree that it is with the older, high-pressure materials, and so must be created artificially. Fully positive, telescoping dies with a force entry clearance of from 0.003 to 0.010 in. have been found to give a good material seal and to produce dense, well-filled parts. Where complicated parting lines make this type of die costly, a semi-positive or landed die will produce good results. Flash-type molds should be avoided except, perhaps, for prototype work.

Because of their easy flow, these compounds tend to flow past dead-ends and high projections. The filling of these areas often is not completed until the material has been at least partly sealed-off by the telescoping die and back-pressure is created. This action tends to form air traps in the dead-ends. To assure dense, well-filled parts these areas should be vented with bleeders or operating knockout pins with a few thousandths ground off one side.

Maintaining high strength

One of the most interesting problems confronting this section of the industry is that of main-

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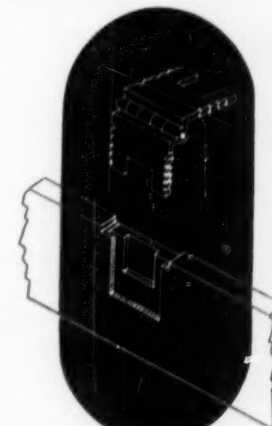

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taining the available high strength throughout an entire molded piece. Part of the solution is in mold and part designs, much of it is in molding techniques, and some of it has not yet been obtained. The problem arises from the inherent tendency of fibrous reinforcing agents to align themselves during flow, often unfavorably. This causes knit and flow lines which are differentiated as follows: A *knit line* occurs when two separate fronts of material meet after flowing around a mold obstruction such as a pin; a *flow line* is created when one area of a single moving front of compound fills out before the adjoining one. As the second area moves to complete the fill, it causes a tearing and fiber aligning action between the two areas, weakening the part along this "junction" line.

Where maximum hole strength is required, elimination of knit lines through mold design can be accomplished by molding pins or cored holes about two thirds of the way through the part. This allows a flow of material across the pin area, preventing a knit line beyond. Naturally, a drilling or punching operation is necessary to remove the remaining material. In electrical components where large numbers of holes are frequently encountered which must be molded completely through to reduce finishing costs, the holes should be located at least $\frac{1}{4}$ inch from the edge of the part. With this distance the turbulent area beyond the pin can create good knitting.

Loading techniques can also help this situation in compression molding. If possible, the material charge should be located to cover the area of the core or pin, which will eliminate the point of knit. One note of prime importance is that the material should always be placed in the mold in one charge unless this is impossible. If it is split, a knit line will occur between the charges.

Flow lines in deeper draw thin-walled parts are often more difficult to eliminate. Much depends upon the quality of the compound used and its ability to flow uniformly and carry the fibers well. This problem can be alleviated in part design by making a heavy lip or flange around the rim of a housing. The tumbling action necessary to fill this area helps form a solid reknit, besides stiffening the rim area and allowing thinner wall sections for lower cost. During molding, the most aid can be obtained if the charge is placed so that the extremities of the part are all filled simultaneously. This can mean shaping the charge for oddly configurated parts.

Closing speed important

In general, where glass fibers are used as the reinforcing agent, compounds containing over 25% glass by weight require a closing speed of at least 70 in./min. to maintain good fiber distribution throughout a part with less than a $\frac{3}{16}$ in. wall. Slow closing allows the resin to heat up excessively and tend to flow away from the fibers. Lower glass content compounds require progressively slower closing speeds as the glass percentage is reduced, to develop

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AT RIGHT
Mr. Leonard Bonn holds a model of his "Bonn Sonosphere" speaker, produced with DYLITE polystyrene.

BELOW
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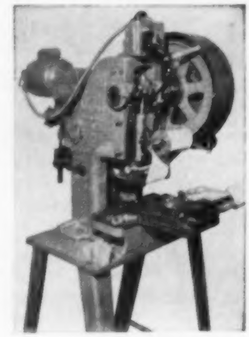

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their maximum properties. The exception to this rule is where hot catalyst systems are employed and a fast close may always be necessary.

Care should be taken when designing ribs for reinforcing the sidewalls of parts over three inches deep if the ribs run parallel to the direction of flow of the compound. A very sharp change from a thin wall to a heavy rib section can cause a differential speed of flow between the rib and the wall. This often creates a flow line at the point of abrupt change, which is evidenced by cracking in this area. This condition will not occur if the ribs are designed with a generous radius at their point of juncture with the thin wall. Ribbing which maintains a constant wall section with the part (i.e., indented on one side and projected on the other) is also satisfactory. Ribs that run at right angles to the direction of material flow seldom give trouble unless they are deep and have no radius at the deepest point, which can cause small air traps. Where already existing tools cannot be modified, the most success in eliminating flow lines caused by ribs aligned in the direction of flow has been found by varying the speed of closing the press.

In transfer or plunger molding the fibers tend to align themselves in the direction of flow through the runners. If a flat rectangular part is then end-gated with the normal, small phenolic gate, the fibrous reinforced compound will ribbon into the mold cavity in lateral folds so that the majority of the fibers are lined up at right angles to the direction of entry into the cavity.

Fan gate suggested

These folds are like laminations and will show as definite ripples in the molded part and often appear as cracks in the gate area where this action is the most severe. The use of a fan gate for this type of part will minimize the trouble, since a wide band of material entering the cavity will not cause the lateral folding to occur. These fan gates need not be thick, as the cross-sectional area of the gate is not as important as the shape.

Although multiple gating has been used successfully in some cases, it is not recommended because of the knit lines formed by the separate entering fronts of material. Following the same line of reasoning, rings or cylinders should be ring-gated or compression molded wherever feasible.

Generally where cost or design allows, all parts should be compression rather than transfer molded in order to make full use of the strength available.

As more information on the compounds and premixes is accumulated and spread throughout the industry, the materials are certain to capture an important share of the market where applications call for strength, electrical resistance, heat resistance, corrosion resistance, and the other desirable properties which only reinforced plastics can offer—at a low cost and in tune with the modern emphasis on high-speed, automated production.—End

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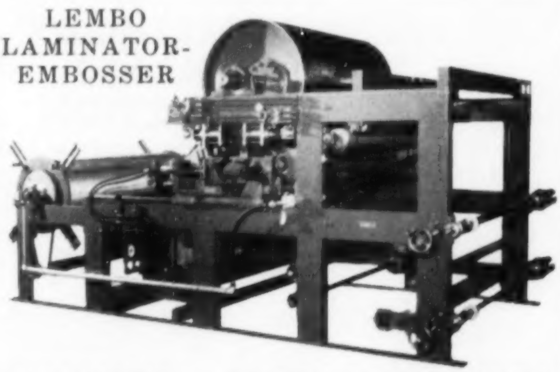

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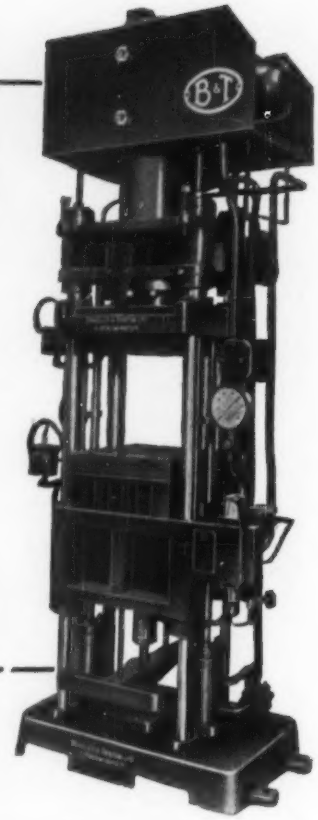

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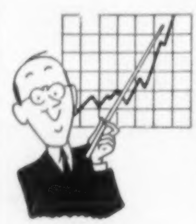

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Styrene gun

(From page 97)

neering the design so that a minimum number of components would be needed. Thus, as many features as possible are molded directly into each part. The main body of the gun, for example, incorporates molded-in gun sight, barrel, contoured handle grip, etc., and is molded in two symmetrical halves that are screwed together. Even the circular track on which the gun belt slides when the gun is being fired is molded directly into the separate magazine section. In addition, to facilitate assembly and dis-assembly, adjacent plastics parts are molded with matching holes through which the assembly screws pass and matching bosses and lugs that interlock.

Because of the resulting intricate design, production of the parts called for precision molding to close tolerances. Two molds are used to turn out all 17 parts. One, a five-cavity mold for the body halves, the two halves of the handle, and the swivel for the tripod on which the gun rotates, is run on a 22-oz. machine. A 55-sec. cycle is used to insure proper dimensional stability.

The other mold is a 12-cavity unit for the magazine section parts, the tripod bases, and the gun barrel end. This mold is run on a 12-oz. machine; the cycle is 50 seconds.

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According to the manufacturers, styrene was selected for the job both for its moldability and its high-impact strength. The toughness and resiliency of the high-impact material proved especially adaptable to the design of the seats within the gun body which support the powerful spring firing mechanism. Tests run on these parts before the gun was marketed proved that they could withstand the constant pounding without breaking.

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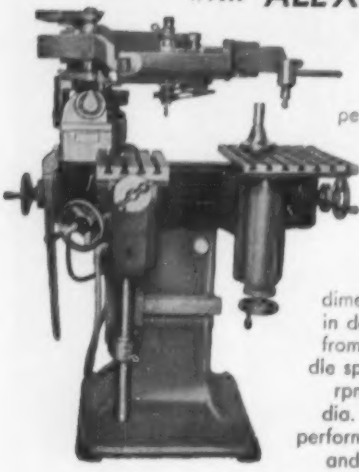

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DDP	1.068	1.086

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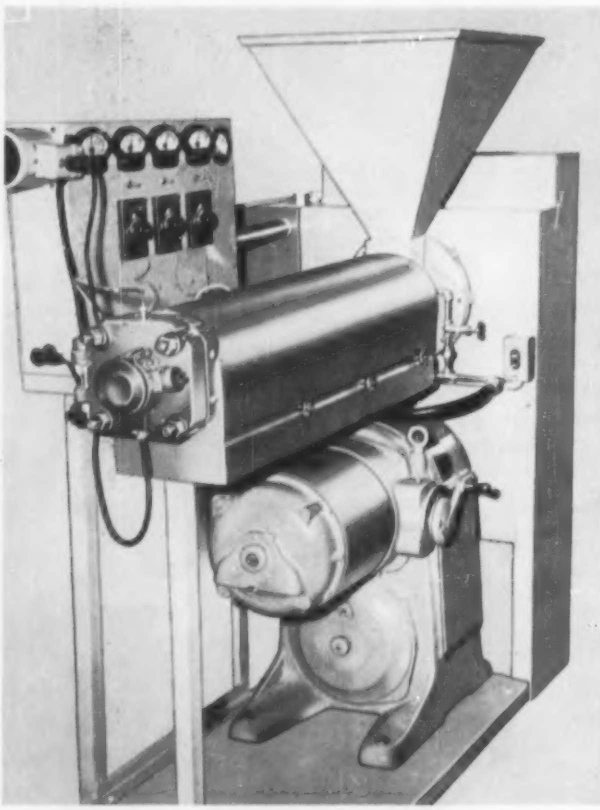

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Plastics in furniture

(From pp. 98-103)

investigating the use of reinforced plastics as basic structural components for various types of furniture.

Marking a possible new trend in the field is a program developed by B. T. Crump Co., Richmond, Va., which is turning out basic chair shells for several furniture producers, utilizing low-cost tools in conjunction with vacuum bag molding. The shells are made of burlap-reinforced polyester material; molded directly into the seat section is one side of a zipper track. After molding, the chair shells are padded and the ultimate manufacturer applies a slipcover with a mating zipper.

An outstanding example of non-reinforced molded plastics furniture is the new all-purpose indoor-outdoor chair produced by Thonet Bros., Inc. This chair has molded plywood legs and back supports combined with a seat and back molded of urea or phenolic, providing a wide color choice. Another Thonet product is a new molded plywood shell chair having a melamine surface which renders the chair resistant to water, heat, alcohol, acid, and staining.

Molded plastics components such as chair arms and chaise longue arms find increasing favor with manufacturers of outdoor furniture. Rexart Metal Industries, Inc., Whitestone, N. Y., and Lawnlite Co., Miami, Fla., are among the companies using molded plastics arms and woven saran fabric or webbing for furniture of this type (photo p. 100). Molded plastics arms offer integral color, resistance to weathering, design flexibility, and freedom from costly finishing operations. Unlike metal armrests, they do not become uncomfortably hot when exposed to the sun. Drawer pulls, drawer rollers, and tips for metal furniture legs are only a few of the many small molded plastics parts used in large volume by the furniture industry.

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CHEMICALS AND PLASTICS. 48-page catalog lists and briefly describes extensive line of industrial chemicals, plastics (including polyethylene polyesters, polystyrene, vinyls), plasticizers, dyes, intermediates, catalysts. Badische Anilin & Soda. (H-603)

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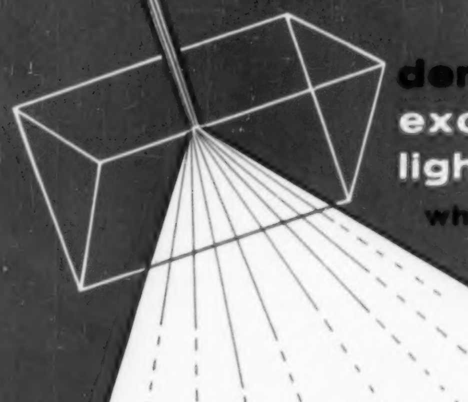

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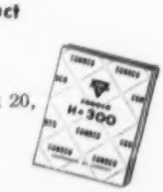

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bins & Myers Hassock Fan, a modernly styled air circulator designed by Sheldon Rutter (photo p. 100). Harmonizing with any decor, this vertical fan doubles as a comfortable hassock. Its attractive external housing, in sea-foam green, is composed of four mating louvered sections injection molded of impact styrene. Secured to a metal chassis, the plastic parts provide 360-degree air circulation and act as a safety enclosure around the fan. According to the manufacturer, a housing of similar design could not have been produced at comparable cost in metal die casting or stamping.

Vinyl Upholstery: New embossed patterns, combinations of basic sheeting with elastic backings for improved application and service, and materials that "breathe" are among the newest vinyl chloride upholstery materials.

While maintaining their supremacy for institutional seating, in the dinette field, and for many outdoor pieces, the vinyls have also been moving steadily into the living room, bedroom, and other parts of the home. "Improvements in texture," states George E. Field, manager of the B. F. Goodrich Koroseal Div., "have taken the 'plastic look' away from vinyl products. We have vinyl upholstery materials today that even the most discriminating housewife can be proud to have on her finest living room furniture. Still, vinyl upholstery retains the properties of washability, stain resistance, and long life which have made it the leading dinette set and restaurant furniture upholstery material."

Air-porous Koroseal, Breathable U.S. Naugahyde, a product of U.S. Rubber Co., and Breathable Fabrilite, made by the Fabrics Div., E. I. du Pont de Nemours & Co., Inc., are some of the newer developments in vinyl upholstery materials. According to Goodrich, air-porous Koroseal contains more than 50,000 microscopic cells per sq. in., which allow moisture vapor and air to seep through its surface. However, it remains water repellent (photo p. 101).

U.S. Rubber's Breathable Naugahyde is produced by a new method of permanently applying vinyl designs to fabric. The material thus combines the breathable feature of fabric with vinyl's familiar durability and resistance to soiling (photo p. 101). Another recently introduced U.S. Rubber product, elastic Naugahyde, has a high slip finish and is suitable for decorative headboards and valances. Combining an elastic supporting fabric and an elastic plastic coating, this product will stretch in every direction, is easy to tailor, and stays permanently soft and pliable.

Du Pont's Breathable Fabrilite, now available in various high-fashion patterns, breathes through thousands of tiny pores, yet has a continuous surface, the company points out. Its soil and wear resistance and washability make even the lightest colors practical for upholstery.

Plastic Foams: Vinyl and polyester (urethane) foams are two of the newest materials winning a place for themselves in the furniture field. Already these plastics are replacing other products—notably rubber foam—in many furniture applications. Some trade spokesmen believe that within the next few years, plastics foams may replace as much as 50% of the rubber foam now used in the manufacture of upholstered furniture and bedding—a market currently consuming approximately $250 million worth of rubber foam annually.

Controlled resiliency, economy, freedom from odor, fire resistance, chemical resistance, and improved finishing characteristics are some of the properties of these plastics foams which appeal to the furniture manufacturer. The compatibility of the foams with vinyl upholstery fabrics is another important consideration, since it means elimination of the cotton cloth divider customarily used when this type upholstery is applied over foam rubber (photo p. 102). In the manufacture of seat cushions, chair padding, etc., the plastics foams may be used alone or with curled hair and other resilient products, as in the case of topper pads in mattresses and some upholstered pieces.

Hudson Foam Plastics Corp.,

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SOLVIC 535 E — Vinyl acetate content: 5%. USES — General purpose copolymer.

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Paste-making PVC resins (plastisols and organosols); suitable for coating of fabrics and paper, dipping, hollow casting or slush molding, and soft cellular products.

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Yonker's, N. Y., a major supplier of polyester foam cushioning, claims that it offers furniture manufacturers better foam cushioning at only half the cost of rubber foam and easier fabrication because of its strength and ability to be tacked, nailed, or sewn; also, materials in the foam are non-migratory to plastics coverings.

Versatility of application of the plastics foams provides the furniture manufacturer considerable latitude. For example, vinyl foam cushions, such as those produced through the Elastomer process by Brown Rubber Co. for school buses, may be made with a sprayed or slush molded skin affording a tough and long-wearing, yet easily cleanable covering for the foam beneath. In making this type of product, mold costs are comparatively low because no metal inserts are required. Full plastics foam cushions, covered with vinyl-coated fabric and having only a thin plywood or aluminum base or mounting plate, are now in use on the New York City subway cars; more than 1000 subway cars thus equipped have been ordered.

Continued acceptance of plastics foams by the New York City Transit Authority and its suppliers is based on the material's fire resistance and superior cushioning qualities at lower cost than competitive materials. As pointed out by Henry E. Allen, vice president and sales manager, Elastomer Chemical Corp., by applying the "integrated skin" technique to seat cushions it may be possible to eliminate the usual upholstery covering, thus escaping the high cost of hand operations. If desirable, such a foam cushion with integral skin could be rendered breathable through multiple perforations of the top surface.

Urethane foams can be bandsawed, stamped, or cut with a hot wire into desired shapes, stapled directly to wood or springs, stitched or glued to fabric, or molded directly into arm rests, head rests, and other shapes. For seat cushioning applications, furniture makers customarily buy the material in slab form, cutting it to the desired dimensions, or purchase the product precut to size, ready for upholstering. Pushbutton-type machinery is now available which automatically levels and cuts urethane foam stock into sheets as thin as 1/16 inch. Coring may be used as required to provide the necessary degree of resiliency.

Nopco Chemical Co., Harrison, N. J., has developed an experimental method of profile-cutting urethane foam from solid slabs by means of a hot-wire technique. Through this process, the foam padding can be profile-cut in one piece and one operation to fit any size or shape. Backs and sides for molded form chairs and seat cushions have been successfully produced by this method. Nopco has also experimented successfully with a mattress which is composed of urethane foam slabs adhered together to produce a coring effect.

Among other organizations, Good Furniture Mfg. Co., Gardena, Calif., is currently using polyester or urethane foam in sheet stock form, principally as a topper or insulator between the fabric covering and the other filling materials in some of its lines of sofas, chairs, and convertible sofas (photo p. 102). Here a primary advantage of the plastic foam, as compared to rubber, is the fact that the upholstery fabric can be dry-cleaned without affecting the foam. Good Furniture Mfg. Co. also promotes the flame resistance of the plastic material. In applications such as sofa arm padding, this company has found that the material is not only as durable as rubber foam, but considerably less costly. Yet, according to Sam Good, executive of the organization, "we haven't as yet scratched the surface as to the full possibilities of the product."

In seeking to meet the competition of the new plastics foams, traditional padding materials are coming up with some new tricks. F. Burkart Mfg. Co., St. Louis, Mo., for example, has announced a new product called Burkaire, which consists of 100% new cotton linters, blended and fused with a plastic binder (photo p. 102). This combination, it is claimed, for the first time makes it possible to produce a cotton upholstery batt of definite shape and

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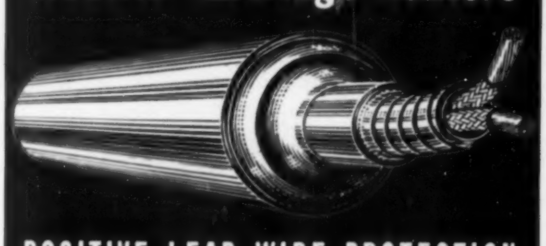

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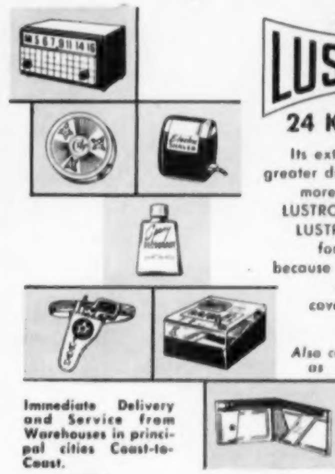

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Miscellaneous Applications: Among the many miscellaneous applications of plastics in furniture which may open up important future possibilities are the use of vinyl plastisol coatings on metal chair backs and the incorporation of high-strength extruded nylon tubing in a new "self-powered" sofa bed which unfolds automatically at the touch of a button.

In a new outdoor grouping introduced by Daystrom Furniture, chairs having plastisol-coated wire backs are featured (photo p. 103). Produced for Daystrom by E. H. Titchener & Co., Binghamton, N. Y., the plastisol on the coated backs gives the wire the desired color treatment and also imparts a soft, comfortable feel to the metal.

In developing its unusual new Hydramatic convertible sofa, which in only 18 sec. unfolds into a full-sized bed, King Koil Sleep Products, St. Paul, Minn., needed a flexible, high-strength tubing which would not be affected by the hydraulic fluid used in the operating mechanism (photos p. 103). A peak pressure of around 1000 p.s.i., supplied by a miniature pump, is required for operation of the sofa's mechanism. After extensive research and burst testing, the manufacturer adopted specially extruded Nylaflow nylon tubing produced by The Polymer Corp., Reading, Pa. Each sofa requires some 67 ft. of the tubing. Among other possible materials tested, thick, black industrial hose proved more costly than the pump and motor combined, and was considered too bulky and unattractive for home use. Steel and copper tubing lacked the desired flexibility. Vinyl and polyethylene tubing, also tested, had adequate flexibility but their burst pressures were too low. The Nylaflow tubing, with a 0.039-in. wall section, will withstand up to 2500 p.s.i.

The Hydramatic sofa illustrates how imaginative design and engineering can open up entirely new market outlets for plastics in the furniture industry. If furniture authorities are correct in their estimate that at least 50% of the furniture now in use in the United States is obsolescent and in need of replacement, furniture manufacturers have a golden opportunity to go "all out" in developing new and functional pieces as modern as today's automobiles, refrigerators, and television sets. With home construction booming along at a rate of more than a million units per year, and with furniture manufacturers putting on a concerted drive to step up their traditional 3% of the customer's sales dollar, the future market for furniture—and the many plastic components used by the furniture industry—looks bright indeed.—END

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EXTRUSION AND INJECTION MOLDING

Originators of Dry Process Plastics Extrusion

Benelux

(*From pp.* 110-114)

against other countries. The import duties in Benelux are the lowest of the whole of Europe. Import duties of 25% are exceptions. Usually only 3% is levied on raw materials, whereas on most semi-manufactured products about 8% is imposed.

Research in Benelux

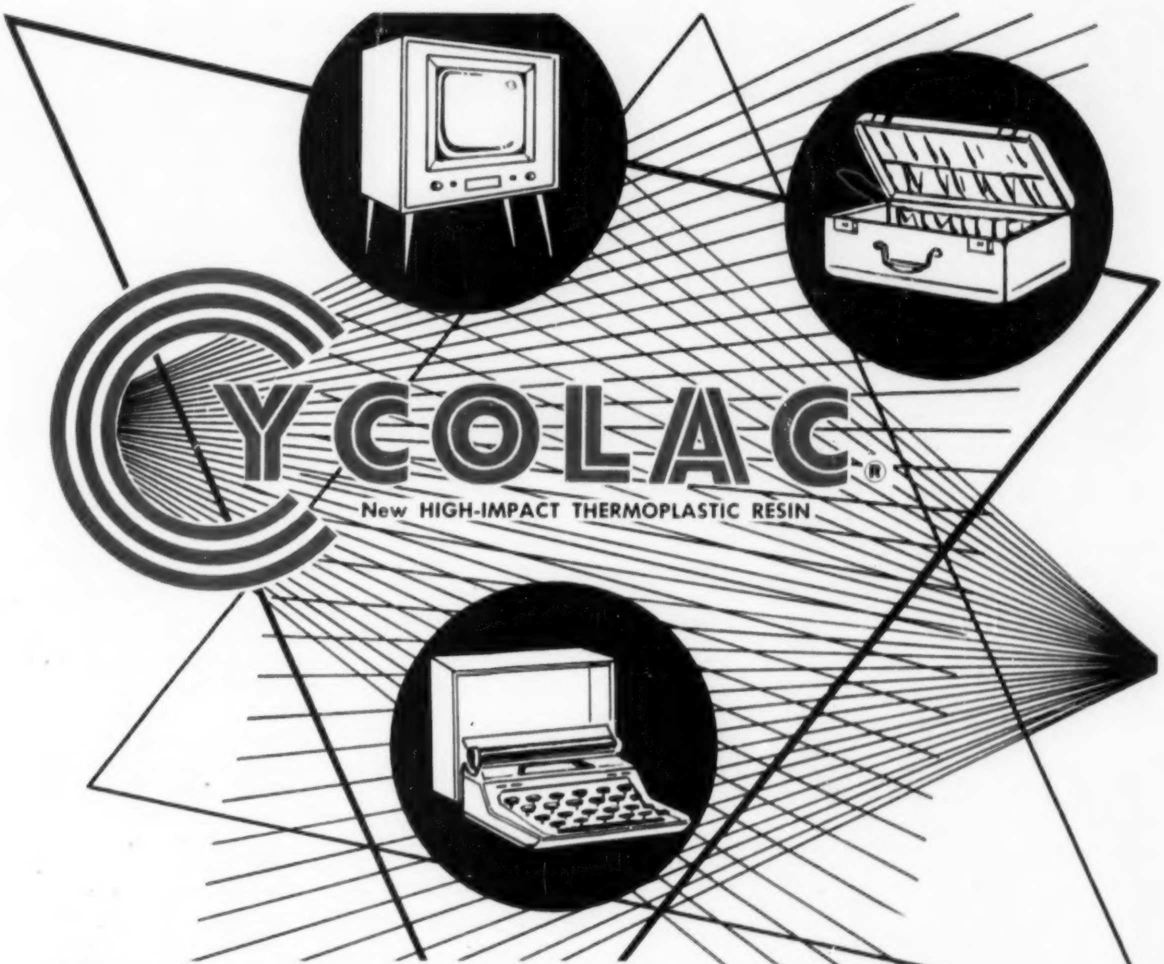
In order to stimulate the research work of the smaller industries and agricultural enterprises, the Dutch Central National Council for Applied Scientific Research (T.N.O.) in The Netherlands was founded in 1931. In the framework of this organization the Plastics Research Institute T.N.O. was established in 1946. In the short 10 years of its existence, it has developed as a research center for plastics, with 230 employees. The research carried out by this Institute in the field of polymers ranges from the fundamental principles of polymer formation, structure, and behavior to the technological and economic evaluation of newly developed processes.

The Institute maintains a well-equipped pilot plant. Furthermore, it serves as an information center for the industry, by means of literature, patent searches, and economic-technical reports, for example. The only Dutch plastics magazine *Plastica* is edited on behalf of the Institute.

Finally, the Institute is active in the fields of testing, analysis, and national and international normalization.

The Plastics Institute is subsidized by the government, but also receives considerable income from research work carried out for the industry.

In Belgium, the collective research work on polymers is done by the centre d'Edudes des Hauts Polymères, which is patronized by the Institut pour l'Encouragement de la Researche Scientifique dans l'Industrie et l'Agriculture. The task of the Belgian organization is principally the furtherance of pure fundamental research. It is partly financed by the abovementioned research organization and the industry.—END



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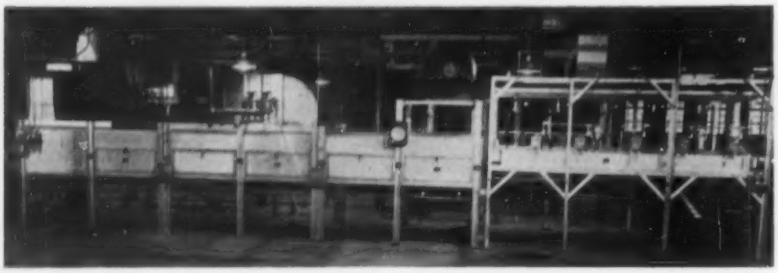

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How much line

(*From page 115*)

toughness, its resistance to corrosion and rust, and the fact that it can be pigmented black to minimize glare.

Molding procedure

All the gears in the train (which includes four compound gears, a spur bevel assembly, one small bevel, and one pinion gear) and the two assembly nuts are produced in a 10-cavity mold; the components for the styrene case—the two halves of the main housing, the dial face, the two parts of the capstan, and the clamping bracket—are turned out in a six-cavity mold.

After molding, the styrene parts go through several finishing steps. First, the two pieces which make up the capstan are joined together and the draft on the capstan is machined off on a special lathe to a tolerance of $\pm$0.001 inch. On the dial face, a special white putty is worked into the molded-in recessed numbers to improve their visibility. Finally, a flat-bottomed drill is used on that half of the case which mates with the clamping bracket to remove the thin web of material left in the assembly holes. Originally, these holes were molded completely in. In those areas where the material flowed around the pins, however, the piece was weakened. Leaving a thin web in the holes that can easily be removed without even requiring a jig proved to be the solution.

The capstan and dial face are then fitted into place in the case and the nylon gears are slipped in proper sequence onto the steel shafts. The two halves of the case are joined together by coating the edges with an adhesive and placing the assembled halves under pressure by a toggle clamp in an eight-station assembly wheel. The weld is set when the wheel makes a complete cycle.

Credits: Trollmeter manufactured by Production Lathe Inc., Burlingame, Calif.; molding by Griffith Tool & Die Co., Burlingame, Calif., using Zytel 101 nylon by E. I. du Pont de Nemours & Co., Inc. and Styron styrene by The Dow Chemical Co.

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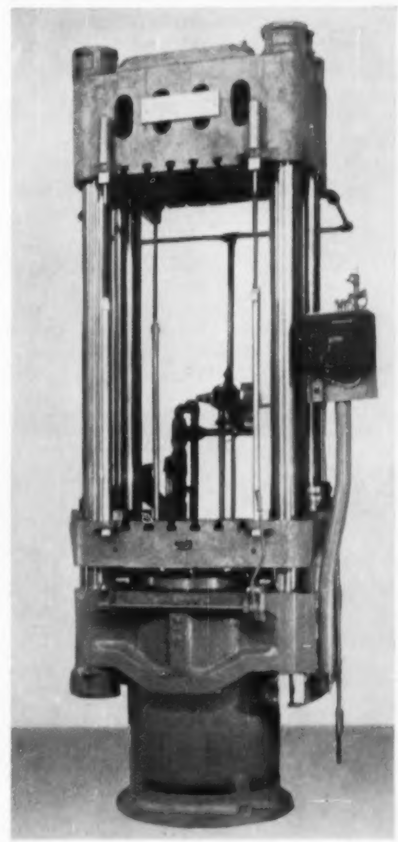

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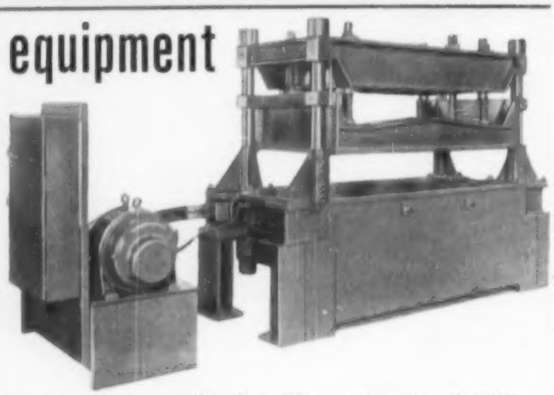

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Mechanical action

(From pp. 139-146)

asymptote at this point represents the maximum strain the specimens can withstand without failure, with a wet spot of ethyl acetate. It appears that it may be possible to establish a point (say 30%) that could be considered the minimum for a passable fused foam. As a simplified testing procedure, a "go-no go" test could be performed on samples stretched 30% and touched with several drops of ethyl acetate. If the sample broke in less than 30 sec., it would not pass and, if it did not break, it would be considered as passable. The exact strain level to be used can be established after more field experience is obtained.

It is of interest to observe that the strain level withstood without fracturing (asymptote to the curve) is approximately the same in both samples of foam (Figs. 14 and 15). That is, the maximum strain level in the most completely fused sample, whether a slice or a block of foam, is approximately 60 percent. The maximum strain level in a moderately fused sample is about 30% and, in a poorly fused sample, less than 15 percent. A wide variety of chemical reagents may be used, however, and undoubtedly different chemicals will produce different effects on different materials.

Fusion (electrical test)

Electrical measurements of dissipation factor and dielectric constant show a slight decrease in traversing the cross-section of foam from slice 1 to slice 18. This can be attributed wholly to the trend in density. The electrical measurements show, however, that electrical tests will not be satisfactory in detecting, measuring, or describing fusion. The mechanical tests (tension) are much more important.

Conclusion

Compression-indentation tests, although necessary to specify the stiffness of the final foam, are not of major importance in the initial development of flexible foam. Compression-fatigue tests, al-

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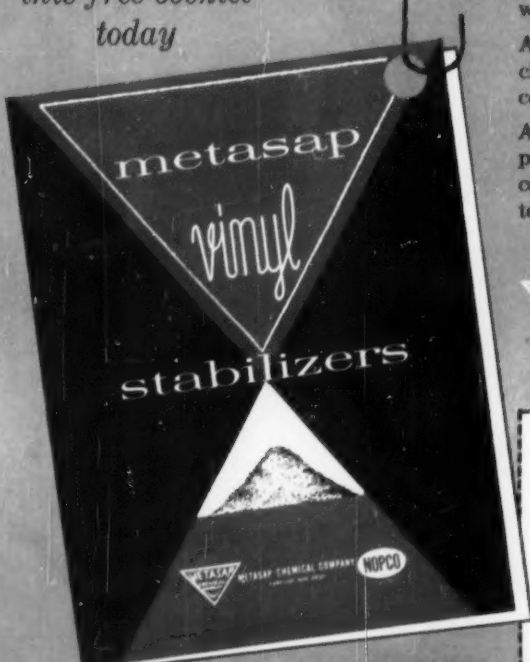

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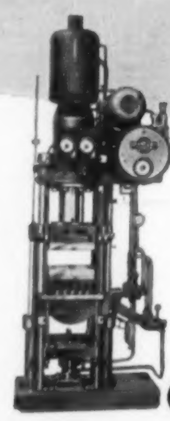

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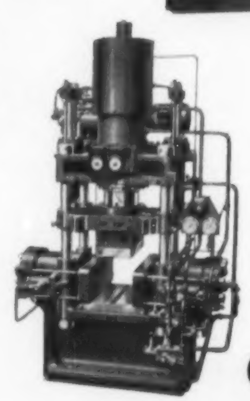

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though indicating differences between foams, are time consuming and difficult to analyze. Tests for fusion are of vital importance, and simple tensile tests on slices of foam are fast and informative.

Data normalization for density will be a refinement that must be considered when the foaming, curing, and fusing problems are better understood.

Compression-set tests at elevated temperatures will undoubtedly be vitally important since they illustrate a great difference between materials.

Summarizing, fusion is the most important problem. When this problem is well understood, the various standard tests may have to be performed, but it is uneconomical to perform them unless the quality of fusion is first evaluated. The development of plastic foam is, of course, still in its infancy. Undoubtedly, new formulations, cell structures, and applications will arise and present problems that, at present, cannot be foreseen. It is important, therefore, to keep the initial tests as simple as possible and to use the more complex simulated service tests only as research and development tools.

Acknowledgments

The authors wish to acknowledge the kind cooperation of Messrs. Karl Balliet (Rubatex Div., Great American Industries); H. N. Grover (Bolta Products Div., The General Tire and Rubber Co.); W. J. Smythe (The Elastomer Chemical Corp.); and F. A. Rideout and W. J. Goodwin (Bakelite Co., a Div. of Union Carbide and Carbon Corp.). Without their cooperation, this paper would not have been possible.

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2. Specifications and Tests for Sponge and Expanded Cellular Rubber Products, A.S.T.M. D 1056-51T.

3. Specification NYCTS No. 1018-C-54, New York City Transit Authority, Car and Shops Department, "Elastomeric Foam Sponge."—End

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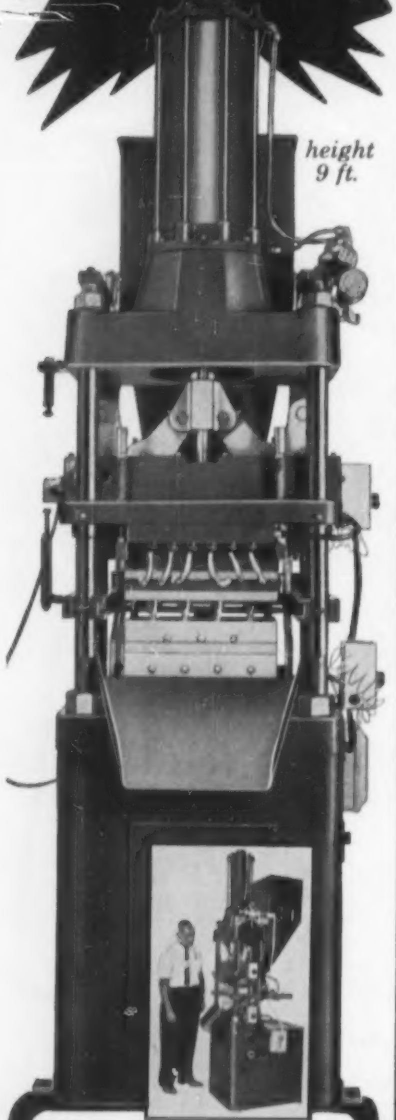

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Polyamide 11

(*From pp. 151–156*)

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[1] R. Dumon, "Le Rilsan dans l'emballage et le conditionnement modernes," Industrie des Plastiques Modernes, Dec. '54.
[2] G. Friard and R. Dumon, "La protection des metaux par concretion de poudre de matiere plastique," Industrie des Plastiques Modernes, Sept. '55.

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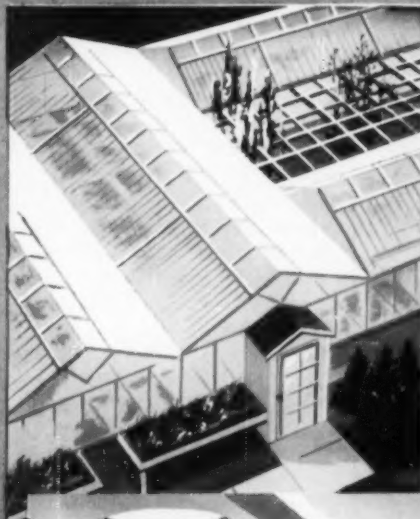

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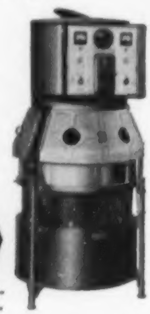

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Thermal properties

(From pp. 158-164)

heater. Differential thermocouples indicated when the guard ring had stabilized at the same temperature as the central heater. Temperatures were measured by thermocouples placed on either side of each specimen panel. Power input to the central heater was used to give an indication of the heat flow.

Examination of the results indicated that several factors entered into the final conductivity value, the primary one being density. As might be expected, the sheets having higher densities tended to displace the conductivity curve upward. All of the materials tested reached peak values between 400 and 500° F., above which the resins volatilized rather rapidly and caused sharp drops in values as indicated in Fig. 7, p. 164. The second important variable is the extent of cure. It was found that with some samples, further curing before testing was necessary in order to insure more reliable conductivity values.

Other factors confusing the issue include: number of voids, warpage and thermal contact, and lay-up pattern. One particular panel, although it had a higher density, gave a lower "K" value than a second panel because of the number of voids. A greater number of plies also tends to decrease the conductivity values because of the increased possibility of forming a greater number of voids along the individual fibers as well as between the layers. Random lay-ups indicated rather constant thermal conductivities, but values were greater than the values for higher density materials. This apparently is caused by parallel lines of high heat conductivity set up by the fiber orientation.

It should be emphasized that the samples used for our testing purposes were manufactured experimentally and were not subject to controlled conditions as large scale production would dictate. In such a production system, variation in voids, density, and cure would be held within definite limits.—END

- a variety of door opening and closing methods—many suitable for automatic-cycle operation
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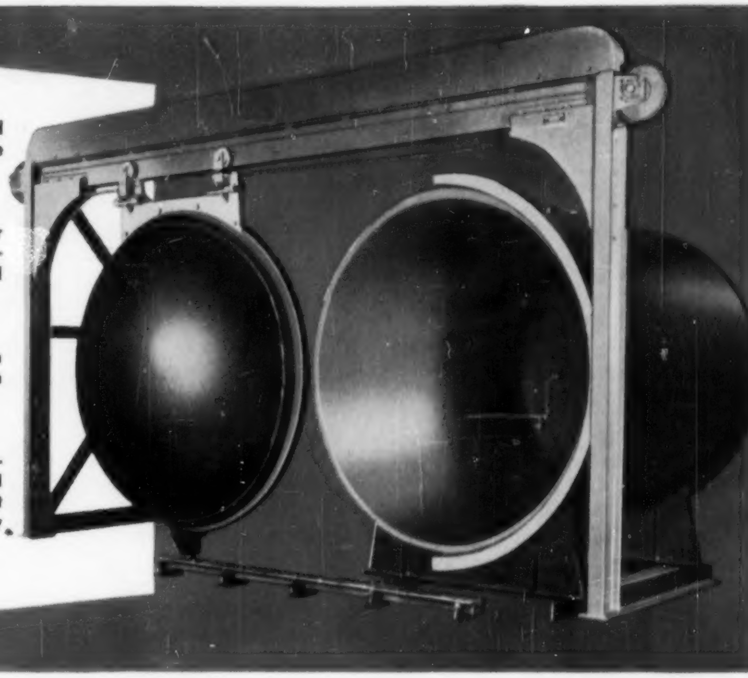

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The Plastiscope

News and interpretations of the news
By R. L. Van Boskirk

Section 2 *(Section 1 starts on p. 41)*

High-density polyethylenes

Confusion concerning the meaning of the words "high-density," "linear," and "high crystallinity," when applied to polyethylene, is growing worse by the moment. Any attempt to simplify this nomenclature is difficult because there is no simple explanation. When Du Pont recently announced that its capacity would be doubled for production of "high-pressure" processed polyethylene and that a great portion of the expanded facilities would be used for producing its new *high-density, high-pressure processed* polyethylene, a spark was set off which lit up a blazing signboard pointing the way to future polyethylene developments. But many plastics people who had been led to believe that "high density" was synonymous with so-called "low-pressure" processed polyethylene are now confused about the meaning of the word "density."

High pressure polyethylene here to stay: The Du Pont announcement had two particularly significant facets. One is that Du Pont has supreme confidence in the future of the *high-pressure process*. The company refused to be panicked when low-pressure polyethylene, polypropylene, and other new polyolefins were introduced to the public. Although Du Pont will produce these low-pressure materials some time in the future, company executives are apparently convinced that high-pressure processing will remain a major factor in the industry for many years to come. The other significant factor in the announcement is that Du Pont's new *higher density, high-pressure* polyethylene formulations—Alathon 34 and 37—are expected to move into many applications where their higher heat resistance and greater stiffness will be good enough to make them competitive with *low-pressure polyethylene*. These formulations may also obviate the possibility that blends of high- and low-pressure polyethylenes will become necessary in the future, for Alathon 34 and 37 already have the properties that would be acquired by such blending.

*Reg. U.S. Pat. Off.

Density of polyethylenes varies: "High density," "high crystallinity," and "linear" are terms frequently used to point out the differences between high- and low-pressure polyethylene. For practical purposes, density is almost the same as specific gravity. Before the new Du Pont resins came on the scene, the density of their high-pressure polyethylene was listed at from 0.914 (Alathon 14) to 0.923 (Alathon 10, 10A, 16, 16A, and 17). The new Alathons (34 and 37) have a density of 0.930. I.C.I. in England has a new high-pressure polyethylene with a density of 0.940. Bakelite has just announced a new "intermediate density" molding resin with a density of approximately 0.923. Density of the low-pressure polyethylenes can be as high as 0.960.

How density is determined: High crystallinity and linear formation are factors that help to create high density. Roughly speaking, high crystallinity means that the molecules are packed closely together; linear means that they are in long, straight chains that can be laid close together with no branching interference. The formation might be described as a bundle of sticks without twigs sticking out to prevent tight or close alignment. All of the new *high-density* polyethylenes, *both* high- and low-pressure, tend to have this linear characteristic. The low-pressure polyethylenes appear to have it to an even greater extent than the new Du Pont high-pressure formulations. The older high-pressure polyethylenes have branching chains—the branches thus prevent such close alignment as is found in low-pressure polyethylene or in Alathons 34 and 37.

These new *high-pressure, high-density* polyethylenes are already being called *intermediate densities* in the trade.

Helps determine properties: It is high-density, highly crystalline, and linear molecular structure that gives higher heat resistance, greater stiffness, less permeability, better clarity, greater tensile strength, and some other properties to the new polyethylenes. But higher crystallinity *may* also result in a more brittle end product. The tensile strength is greater, but the across-the-grain strength is less.

There are many cases in which flexibility is more desirable than the stiffness which is characteristic of higher density materials—squeeze bottles are one example, molded containers with snap-on lids could be another. It is also possible that some day a low-pressure polyethylene may be developed which will minimize so-called brittleness problems.

High-density film is more stiff: Polyethylene film produced from the high-density, high-pressure polyethylenes is considerably different than that produced from the older high-pressure polyethylenes. Generally speaking, it has better clarity and its greater stiffness will to some degree make it easier to handle on a packaging machine. It has great strength to resist a steady pressure, but its impact strength under a heavy load is not outstanding—a deficiency that is to be expected since there is a general rule that impact strength decreases as crystallinity increases.

Thus if the film is used for a bag holding 10 lb. of potatoes or apples, it *might* break if the

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Hailed as the "world's fastest combat plane," the top speed of the new, supersonic F-104A Starfighter is still "Confidential Information."

This speed, where fractions of seconds count in combat, required specially designed windshields and canopy to give greater visibility for the pilot. Because of the critical optical requirements, their production was logically entrusted to Swedlow's specialized skill and experience in plastic enclosures.

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loaded bag were dropped. Du Pont, therefore, does not suggest Alathon 34 for heavy-duty bags. But, they report that because of its clarity and other properties, it is being widely used for textile wrapping and other applications where its unique properties are advantageous. Some day it may even be used for lettuce wrappers.

Another advantage of film made from Alathon 34 is that it has good slip—no additive or interleaving material is needed to prevent the film from sticking to itself on the take-off roll.

New molding material: Du Pont's Alathon 37 is an *intermediate density* material (0.930) suggested particularly for molding. Both 34 and 37 have the same density, but 34 has a melt index of 2.0; 37 has a melt index of 12.0, thus indicating that it is an easy flow material. It isn't as stiff as low-pressure polyethylene, but is still rigid enough for many applications where that property is desirable. Furthermore, it has a high enough heat distortion point to withstand limited boiling. It has an exceedingly high flow; a short molding cycle; and an exceptionally fine glossy surface—not so brilliant as polystyrene, but better than Du Pont's older polyethylenes. It is suggested particularly for large moldings, such as garbage pails, laundry baskets, and other large container-type applications.

These two *intermediate density* resins (the term "intermediate density" is used interchangeably in this article with "high-density, high-pressure") are on the market at 43¢ a pound. Standard film and molding polyethylene are 41¢ a pound.

Naturally, Du Pont has not released any details on how they have increased the density of high-pressure processed polyethylene. It is understood that variations of pressures, temperatures, additives, and catalyst are all involved in the production process. Molders and film producers don't care, anyhow; they are interested in the different properties exhibited by the new resins.

Older resins also improved: Du Pont is, of course, enthusiastic about the new resins mentioned above, but this enthusiasm has not halted work on improvements in their older resins during the past year or so. For example, the company now has eight different film grade resins tailored to meet varying degrees or combinations of low-temperature toughness, stiffness, transparency, impermeability, frictional properties, and heat distortion. Some molders even prefer film grade resins for certain molding applications, such as various types of containers. There are also three types for bottles which are specially tailored for good impermeability, stress-cracking, and heat distortion. Incidentally, two of the three are also suggested for film.

Seven of the Du Pont resins are tailored for molding, with such properties predominating as toughness, resistance to stress-cracking, stiffness, high flow, glossy surface, and higher heat distortion, depending upon which are most needed by the molder. And there are also variations of wide range for resins used in coated paper, pipe, and electrical purposes. The company now has more than 40 formulations based upon 16 principal resins.

Polyurethane prepolymer

Resilient water-absorbent foams can now be produced with a new polyurethane prepolymer developed by Thiokol Chemical Corp., Trenton 7, N. J., and designated ZL-239.

Foamed materials made from ZL-239 are said to be of uniform cell size and smooth texture, and to combine resilience and strength, both wet and dry, with water absorption properties equivalent to those of cellulosic materials. Water pick-up of ZL-239 foams is claimed to be about ten times that of conventional polyurethane foams, making them suitable for industrial and household sponges, mops, wiping cloths, and other products requiring high water pick-up and permanent resilience.

ZL-239 is packaged as a three-component mix to assure stability. One component is an emulsifier, a second is the prepolymer, and the third is a catalyst. Storage for three months under ambient conditions has shown no change in viscosity or foaming performance of the mix.

New stabilizer

A powdered barium-zinc soap vinyl stabilizer, Advastab XBZ-155, for use in calendering, extrusion, and floor tile has been announced by Advance Solvents & Chemical, Div. of Carlisle Chemical Works, Inc., 245 Fifth Ave., New York, N. Y. The new stabilizer is said to be completely free from the effects of hydrogen sulfide staining; it is effective in heavily pigmented compositions, tile, and in the presence of phosphate plasticizers.

Advastab XBZ-155 is priced at 69¢ a lb. in 200-lb. drums.

Free trip via plastics

Merchandising of plastics products has gone through all sorts of gyrations since plastics became a consumer item with mass merchandising potentials shortly after the war. The newest effort is an old stunt with a different twist insofar as plastics merchandising is concerned. The plan is a Pantasote promotion. The company is offering two round-trip flights from New York to Paris for the winner of a contest who can form the most four-letter words from "Pantasote Premium," which is the brand name for the company's vinyl film, sheet, and coated products.

Editorial note: Part of the above company's promotion material consists of sound, practical information to the housewife on how to take care of "plastics products." But the producer uses only the word "plastics" in his description. The same care may not always be needed or even be successful with other plastics. This

"45,000 more plates a month..."

LUSTREX* HI-FLOW 66

boosts production 7% on thin-wall injection molding

C. B. Cotton Company of Brooklyn, N. Y. specializes in molding for the highly volatile, small-item retail field, where volume production of a new product often is demanded overnight.

"That's why we chose Lustrex Hi-Flow 66," points out R. B. Edwards, Cotton's plant superintendent. "Experience has shown us it's the fastest, most satisfactory crystal for our thin-wall work."

Typical of their fast-moving operation is the molding of picnic plates... using a 2-cavity mold with 125 inches of projected area. After switching to Lustrex Hi-Flow 66, short shots and flash problems were eliminated. Operational temperatures were down from 610° to 560°F., and set-up time was cut from 15 to 10 seconds.

Since the change to Lustrex Hi-Flow 66, C. B. Cotton Company has increased production by 45,000 picnic plates per month from one press alone. Cotton further reports that the improved color dispersion of Lustrex Hi-Flow 66 produces a finished plate with deeper color tones and greater luster.

"Lower operational temperatures," says Plant Superintendent Edwards, "have greatly increased heater band use life. And, we don't have to worry about scrap due to burned or warped moldings."

Production speed-up, maintenance economies, and finer finished products are possible on many jobs with Lustrex Hi-Flow 66 styrene. Lustrex Hi-Flow 66 is a medium flow, general purpose styrene especially recommended for thin-to-thick wall applications.

Ask your Monsanto representative about Lustrex Hi-Flow 66 and other crystal compounds supplied by Monsanto to provide you a "Balanced Product Line" for your particular operation. Or write to Monsanto Chemical Company, Plastics Division, Dept. 668, Springfield 2, Mass.

*LUSTREX: REG. U. S. PAT. OFF.

MONSANTO LUSTREX Styrene Plastic

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would have been a particularly good spot to have used the word "vinyl" instead of plastics and help start an industry-wide campaign that would teach housewives that such things as vinyl, polyethylene, polystyrene, et al., are as different from each other as iron, copper, nickel, aluminum, and other metals. It is high time that processors stop using the word "plastics" and concentrate on the generic name of the particular plastic they are using.

Teflon-glass combination

Du Pont's Armalon, Teflon-coated glass fabric, finds uses in those packaging applications where non-sticking surfaces are required but where the coating of equipment surfaces with Teflon is not practicable; in heat-sealing operations, it is applied between the surface of the sealing iron and the packaging material to prevent a build-up of the material being sealed, thus eliminating carbon formations and increasing production efficiency and package uniformity. It is said to be equally effective with hand-sealing irons or automatic operations.

The material is now also available in laminates for covering work benches and in fabric rolls for conveyor belts. Experiments are being conducted with Armalon fabric work gloves and aprons.

Distribution of Armalon is being handled by General Plastics Corp., 165 Third Ave., Paterson, N. J., and American Durafilm Co., 2300 Washington St., Newton Lower Falls, Mass.

Rubber reinforcing resins

Resins for rubber reinforcing which are readily dispersible with natural and nitrile rubbers at all loadings have just been added to the line of British Resin Products, Ltd., Devonshire House, Piccadilly, London, W.1, England, under the trade name Cellobond. They are cashew phenolic-type resins. One is supplied in lump form and requires the addition of hexamine. It is particularly useful in hard and semi-hard rubber stocks. There is also a powder form of this type which is furnished with 8% hexamine added. Higher melting counterparts of these resins (105 to 115° C.) are suggested for use with copolymers of high acrylonitrile content, such as Hycar 1001, which give increased tensile strength. They also give increased modulus and hardness to natural rubber. They are thermoplastic in the uncured state but cure during the vulcanization process to form an integral part of the system.

Owing to the initial *thermoplastic* nature of these resins, they facilitate the processing of highly loaded stocks, while at the same time reinforcing hardness and other physical characteristics. When high filler loadings are employed (particularly carbon blacks) in the absence of conventional processing aids, little resin is needed to impart a marked increase in hardness.

New molder

Formation of Brook Molding Corp., 30 Industrial Way, Norwood, Mass., has been announced. The new firm will specialize in injection, compression, and transfer molding of industrial products.

F. Reed Estabrook, Jr. is president; Colin M. Cunningham, vice president and sales manager; and Frederick K. Whiting, treasurer.

Powdered nylon reduced

A price reduction of approximately 40% on its series of Nylasint finely divided nylon powders has been announced by National Polymer Products, Inc., a sales subsidiary of The Polymer Corp., Reading, Pa.

A major use for the powders is to form parts by a process of high-speed cold pressing followed by oil sintering. The cold pressing is performed in standard powdered-metal presses. The powders have also been used as additives to epoxy, phenolic, and other resins to increase abrasion resistance as well as to suspend metallic fillers. In addition, they are being added to optical polishing pitches and slurries to reduce scratching and decrease polishing time.

Con-Tact in the nursery

Extending its line of pressure-sensitive-adhesive-backed vinyl sheeting, Cohn-Hall-Marx Co., 40 W. 40th St., New York, N. Y., is now offering Mother Goose and other cut-outs for quick-change decorations of nursery walls, furniture, and accessories.

As with all Con-Tact products, it is only necessary to strip off the protective paper backing and press the vinyl on the surface to be decorated. Ultron vinyl sheeting for this application is supplied by Monsanto Chemical Co.

Pigment dispersions down

Price of pigment dispersions for P.V.C. and polystyrene has been reduced an average of 25% (and as much as 40% for some products) by Acheson Dispersed Pigments Co., a unit of Acheson Industries, Inc., Philadelphia, Pa.

White paste other than antimony oxide will bear a base processing charge of 11¢ a lb., plus raw material costs; color pastes other than phthalocyanines and carbon blacks will be charged at the base processing rate of 15¢ a lb., plus raw material costs; antimony oxide, carbon black, and phthalocyanine paste prices will be quoted individually on current orders; and dry granulations will be processed to customer requirements at a base processing charge of 26¢ a lb., plus raw material costs. For all dispersions, raw materials will be charged at current market price at time of order, plus 5% for shrinkage.

Nylon-6 tubing and bags

Experimental quantities of extruded blown-flat nylon tubing and heat-sealed bags are being produced by Kemtek Corp., 206 Sylvan Ave., Newark, N. J. The material being used is type 6 nylon, a polymer based on caprolactam.

The film is claimed to be capable of withstanding either steam or dry sterilization in an

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autoclave with no loss of physical properties; to be resistant to most solvents, being adversely affected only by strong mineral acids; to be sealable (heat or high-frequency); to be printable by any standard method without special surface treatment; and to resist the passage of oxygen and other gases and liquids, while allowing slight transfer of water vapor.

New resorcinol plant

A 3 million-lb.-capacity resorcinol plant will be constructed by Heyden Chemical Corp. at Fords, N. J. Resorcinol is an intermediate in the production of resorcinol-formaldehyde adhesives, dyes, pharmaceuticals, and other products.

The new plant is expected to be completed by the end of 1957. Heyden will discontinue its original commercial resorcinol unit at Garfield, N. J.

Imported molds

Injection, compression, and transfer molds from Europe are now available in the United States through Dinn & Walker, 2 E. 23rd St., New York, N. Y., with offices in Germany and England. Full-shot samples are provided before delivery.

A New York engineering firm is employed by D & W for technical assistance and advice. The company presently has the facilities of 15 mold-making firms under contract and will increase this number to 25 by the end of the year.

Government okays plasticizers

Paraplex G-62 has been approved by the Food and Drug Administration, Department of Health, Education and Welfare and the Meat Inspection Branch, United States Department of Agriculture for use as a plasticizer in compounds utilized in the packaging and conveying of food products. Approval includes use as a plasticizer in films for packaging bacon, lard, oleomargarine, and other meat products in federally inspected meat plants, as well as for packaging water-containing food products such as fruits and vegetables.

Acceptance by the United States Department of Agriculture, Meat Inspection Branch, and Food and Drug Administration includes usage of Paraplex G-62 up to 35% of the total compound. Paraplex is a product of Rohm & Haas Co., Philadelphia, Pa.

The company also announces price reductions on the following plasticizers: Paraplex G-40, 48¼¢ a lb.; Paraplex G-50, 39¢ a lb.; and Paraplex G-53, 43¼¢ a pound. These prices are for tank-car quantities; smaller quantities are correspondingly higher.

Call for S.P.I. papers!

The twelfth annual technical and management conference, to be held at the Edgewater Beach Hotel, Chicago, Ill., in February 1957, is now being organized by the S.P.I. Reinforced Plastics Division.

Papers are invited for presentation at the conference on the following subjects: *Management sessions*—foreign, sales, cost estimating and control, safety and industrial hygiene, personnel training and development, and research and development; *technical-engineering sessions*—premix, prepreg, mold makers, plastics for tooling, materials, preform, industrial design, and finishing.

Metallizers organize

American manufacturers engaged in metal-coating plastics films by vacuum processes have formed the Vacuum Metallizers Association. The program of the association includes the promotion of standardization and simplification of products; the collection and dissemination of statistics and other information relating to metallized plastics films; the advancement of fair trade practices; the distribution of information of a general commercial, economic, and governmental character; and the presentation of the views of the industry to other organizations, the government, and the public.

Officers of V.M.A. are: President—Milton Hammer, president of National Metallizing Corp.; vice president—John Hastings, vice president of Hastings & Co.; secretary—Clark Taylor, vice president of Metallized Products Co.; and treasurer—Heber Allen, general manager of Industrial Div., The Dobeckmunn Co. The membership includes the major commercial manufacturers of metallized plastics films.

Two glass papers

All-glass "paper" is now being offered by the Textile Div. of L.O.F. Glass Fibers Co., Toledo, Ohio. Designated Micro-Fiber paper, the reinforcement is claimed to make reinforced plastics products more durable and give them a smoother finish.

According to the company, reinforced plastics using the glass paper as a surface material offer a high degree of resistance to erosion because the extremely fine fibers in the paper hold down the coarser fibers underneath.

Another glass fiber paper, called Dexstar, has been announced by C. H. Dexter & Sons, Inc., Windsor Locks, Conn. This particular product, made on a conventional paper machine, is said to receive fine-quality printing on its surface, with no tendency of the ink to bleed.

Hardening of coatings

The Chem-Dry process, developed by The Meyercord Co., Chicago, Ill., is claimed to replace air-drying operations in the setting of inks, varnishes, and paints —but not lacquers. Based on a chemical reaction between the applied coating and sulfur dichloride vapor, the hardening is completed in a few seconds without use of heat.

Coated materials are conveyed through a chamber containing a mixture of sulfur dichloride (SCl_2) and air, where the surface reacts immediately to give an initial set. In a few seconds the coating absorbs enough SCl_2 to complete the hardening after it leaves

Whatever your plastics problem bring it to I.C.I.

I.C.I WILL HELP YO[illegible] CH[illegible]ne right plastics material for the job you [illegible]e in mind. They will settle any problems you may have concerning suitability, cost and production. When you have decided on the material and the process, they will give you the benefit of their Technical Service which is world wide. From then on it is plain sailing—mainly because stringent technical precautions are taken to ensure that the very high quality of I.C.I. materials *never* varies.

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the chamber. The chamber must be fitted with guard chambers under suction to keep the active vapor from escaping to the surrounding air.

By suitably modifying the coating formulation, surface finishes from glossy to matte can be obtained without special treatment. The SCl_2-hardened finishes are usually harder than their air-dried counterparts and never become tacky, regardless of weather conditions.

H. L. Barnebey, 835 N. Cassady, Columbus, Ohio, is exclusive licensing agent.

Polyester formulation

A complete line of polyester resins, designated Amester, is now being produced by American Alkyd Industries, Carlstadt, N. J. The line includes: Amester 722—general purpose; 722 L.S.—light stabilized; 502—reactive; 552—matched-metal die resins; 722 L.V.—low viscosity; 822—thixotropic; 852—fire retardant; 922—flexible; and 1022—gel coat.

The company also has available Amester polyester resins for rigid and flexible foams, based on polyester-isocyanate formulations.

Bright toners offered

Two new azo red toners have been added to the line of colors produced by the Pigment, Color and Chemical Div., The Sherwin-Williams Co., 260 Madison Ave., New York, N. Y. Designated Arcturus Reds, they are brilliant, yellow-red shades produced in resinated and non-resinated forms. The resinated, Arcturus Red CP 1275, exhibits the usual differences from the non-resinated color, Arcturus Red CP 1270, which is slightly brighter, yellower, and darker.

According to the company, the new pigments are well suited for use in vinyl and polystyrene; they exhibit no migration and only slight bleeding in soap solution; and they show no crocking.

Another colorant recently developed is Pyrolux Maroon D-3148, an organic color pigment claimed to have excellent heat and light resistance and good permanence. It is recommended for vinyl, polystyrene, and polyethylene applications.

Anti-static Teflon coating

Development of an anti-static coating for industrial equipment has been announced by General Plastics Corp., Paterson, N. J. Designated Gencote 108, the coating is based on Teflon modified to be electrically conductive. The manufacturer claims it achieves an anti-stick, dry-lubricated, chemically inert surface that is anti-static as well.

When applied in a 4-mil film, the electrical resistance across the coating is approximately 1 ohm. Surfaces can be coated in multiples of ½ to 10 mils on any material that can withstand the 700° F. required for baking.

New fatty alcohol

A new saturated fatty alcohol, called Adol 45, has been announced by the Chemical Products Div., Archer-Daniels-Midland Co., 2191 W. 110th St., Cleveland, Ohio. Adol 45 is a long-chain diol with a high melting point of 69° C. It is a practically odorless hydroxy stearyl alcohol derived from hydrogenated castor oil. The material is suggested for compounds such as plastics, resins, solutions, stabilizers, emulsifiers, polyesters, and surface active agents.

Honeycomb support

In an adaptation of the "lost wax" process, Hot-Melt H-883-A, a thermoplastic of undisclosed composition produced by Furane Plastics, Inc., 4516 Brazil St., Los Angeles, Calif., is used for filling honeycomb cores to facilitate later machining of stainless steel honeycomb structures. In practice, the material is melted at a temperature near 200° F. and poured into the honeycomb or the core inserted into the melt. After cooling, the thin walls of the honeycomb have sufficient support to be readily machined (without proper support during machining, the structure would collapse, tear, or burr). After machining, H-883-A is melted from the honeycomb and the structure cleaned with hot water.

Non-dermatitic hardeners

Water repellent hardeners 946 and 986 for epoxies, produced by Furane Plastics, Inc., 4516 Brazil St., Los Angeles, Calif., are claimed to be low-toxicity materials which have been found to be non-dermatitic when subjected to the Patch test method.

Hardener 946 has a pot life of from 10 to 15 min. and 986 from 25 to 30 min. at ambient room temperature.

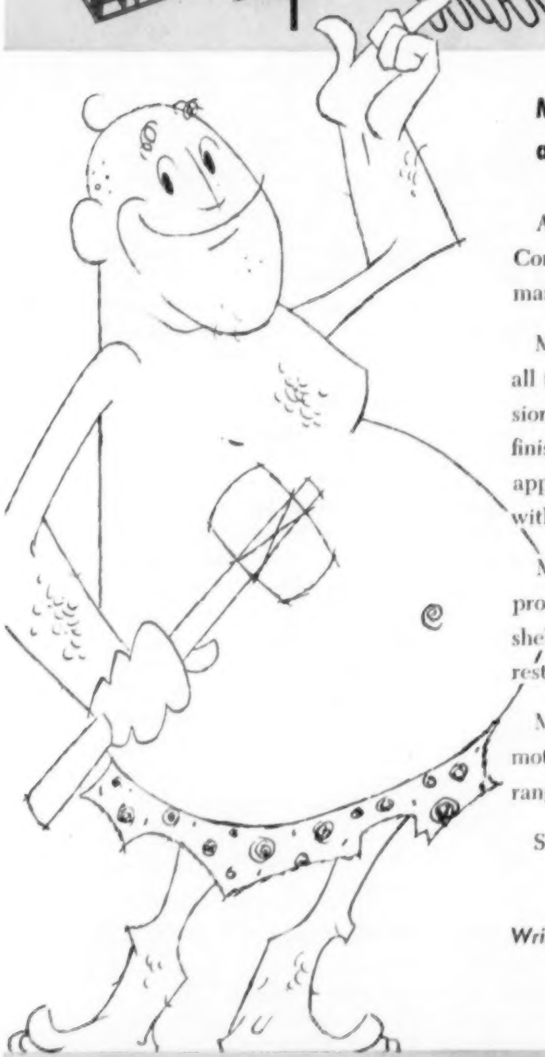
New S.P.I. chairman

The Reinforced Plastics Div. of The Society of the Plastics Industry, Inc. has elected Clare E. Bacon chairman for one year. Mr. Bacon, manager of custom molded sales of Owens-Corning Fiberglas Corp., succeeds Samuel S. Oleesky, vice president of Zenith Plastics Co.'s Micronics Div. Mr. Bacon has been with Owens-Corning since 1941 as manager of research and development, manager of product development, and manager of technical sales service before assuming managership of sales to custom molders this year. This entire period has been spent in the Reinforced Plastics Div. of Owens-Corning.

Polyethylene concrete separator

Here is another in the rapidly pyramiding uses for polyethylene in the construction industry. Robert E. Lamb & Sons, a Philadelphia construction firm, has found polyethylene film to be a time and money saver in separating fresh poured concrete panels used for walls in tilt-up slab construction methods.

The Visqueen film which Lamb uses is placed on top of a concrete panel after it is poured, and the next slab is poured on the film. The film prevents a bond from forming between the two slabs. Bond breakers formerly used



Miccrosol Coatings are Tough, Resilient, Abrasion and Corrosion Resistant, Attractive, and Colorful

A pioneer in plastics, Michigan Chrome and Chemical Company has always been a leader in the development and manufacture of vinyl plastisol coatings for industry.

Miccrosol E-1003 has long been the accepted standard for all types of industrial coatings. It is tough; chemical, corrosion, and abrasion resistant; resilient; and has a high-gloss finish. It is now available in formulas for any method of application including: dipping, slush molding, and spraying with conventional equipment (hand or automatic).

Miccrosol has proved to be the ideal coating for wire products of all types: dish-washer baskets, farm baskets, shelves, household articles, racks for materials handling and restaurants, dish-drain baskets, and a host of related items.

Miccrosol is also available as a coating for appliances, automotive parts, fabrics, and furniture. It is offered in a wide range of colors to meet the requirements of the manufacturer.

Solve your coating problems with Miccrosol!

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were chemical solutions which could not be trusted to do the job as consistently, according to the construction firm.

The time required is only that needed to spread the sheet over the poured slab. The price per slab is reduced because the film may be used as a bond breaker more than once, and may later be used for various other purposes at the construction site.

Teflon rod line expanded

A total of 22 diameters of extruded Teflon rod, from 0.125 to 1.000 in., are now offered in increments as low as 1/32 in. by Tri-Point Mfg., Inc., 401 Grand St., Brooklyn, N. Y.

Intermediate diameters are available as centerless-ground. Tolerances on diameters up to 1 in. are kept to 0.001 in. and within 0.002 in. on rods over 1-in. diameter. Standard rod lengths available are 12 ft. for diameters up to 0.562 in. and 10 ft. for larger diameters, with longer stock provided where required.

Celanese fellowships

Graduate fellowships in 13 universities have been established by Celanese Corp. of America, 180 Madison Ave., New York, N. Y. Fields of study covered include plastics, cellulose, chemistry, engineering, physics, and textiles.

Destaticizer

A compounding material for plasticized vinyls, claimed to render the product virtually free of static charges, has been announced by Baird Chemical Corp., 254 W. 31st St., New York, N. Y.

Designated Antistat A, the destaticizer is said to be a compatible, conductive liquid, light amber in color, which is easily incorporated into the resin without noticeable effects on the properties of the vinyl; it is free from amine groups and is stable at the usual processing temperatures; its odor is negligible; it may be used in clear, colorless films as well as in colored films; and it does not affect the printing properties of the vinyl nor does it have any effect on subsequent heat-sealing operations.

Improved laminate

Epoxy-glass laminate Grade G-10-865 (similar to Grade G-10-860) is now available in production quantities from National Vulcanized Fibre Co., Wilmington, Del. The new laminate, which meets MIL-P-18177, is said to be superior in its lower water absorption, lower dissipation factor, and higher bond strength.

G-10-865 is primarily for electrical and electronic uses. It is available in sheet sizes of 39 by 47 in. with thicknesses from 1/32 to 1/2 inch. Standard finish is a semi-gloss and standard color is natural (light brown). It is supplied as either a standard laminate or with copper foil on one or both sides for printed circuits.

Lacquer for butyrate

Specially formulated for coating and decorating butyrate, quick-drying lacquer Rez-N-Lac B, developed by Schwartz Chemical Co., Inc., 326 W. 70th St., New York, N. Y., is said to have permanent adhesion and low flammability.

Rez-N-Lac B can be applied by brush or spray. It is claimed to be non-toxic and completely waterproof and not to flake or craze.

The lacquer can be obtained in all standard colors, either opaque or transparent, in 1-gal. and 5-gal. cans and 55-gal. steel drums. Special colors can be matched in a minimum batch of 5 gallons.

Metal adhesive

A new one-component epoxy adhesive with high heat resistance, said to develop a strong bond between metal parts and between metal and many other materials, has been announced by Carl H. Biggs Co., Inc., 2255 Barry Ave., Los Angeles 64, Calif.

Designated Bonding Agent R-385, the adhesive is 100% resin and asbestos filler and contains no solvent. It is furnished in a heavy paste form and is applied as received with no addition of catalyst or hardener.

R-385 has a shelf and pot life of at least one year. Bonds are cured by baking at 325° F. for one hour. Higher temperatures may be used to shorten the baking period. Only enough pressure on the parts to be bonded to hold them in close contact is necessary to achieve a good bond.

Casein for paints

A biologically stable casein solution for use as a prepared stabilizer, thickener, and leveling agent in latex and emulsion paints has been developed by The Borden Co.'s Chemical Div., 350 Madison Ave., New York, N. Y. Known as Cascoloid ST-50, the 25% casein solution is said to be resistant to spoilage in its natural state and in paint and paper coating formulas.

Cascoloid ST-50 is ready to be added to the pigment grind, or to the pigment slip, or divided between the two. It is packed in 5-, 30-, and 55-gal. drums.

New S.P.I. division

A Vinyl Dispersions Division has been formed within the framework of The Society of the Plastics Industry, Inc. Aim of the division is to help bring about stable, well integrated growth in the vinyl dispersions industry; to develop specifications, physical test procedures, and performance standards on vinyl dispersions for eventual adoption by the industry; and to evolve standards covering vinyl dispersions used for both industrial and consumer applications.

James Hull, of Reynolds Chemical Co., is chairman of the Executive Committee for the new division.

Air-tight bags

Vacuum pouches made from a specially treated polyethylene film, claimed to have extremely high resistance to the transfer of gas, air, and moisture, have been introduced by The Cryovac Co., Div. of W. R. Grace & Co., Cambridge, Mass., manufacturer of

Pittsburgh Fiber Glass Chopped Strand is used as insulating material in this Erico CADDY Electrode Holder. Chopped Strand makes this product stronger, longer lasting, moisture resistant; eliminates warpage and lamination breakdown.

Pittsburgh Chopped Strand insulation in this electrode holder keeps the handle cooler for the welder.

Erico Products, Inc., improved the Caddy Electrode Holder 5 ways with Fiber Glass Chopped Strand

Erico Products, Inc., Cleveland, Ohio, manufactures CADDY Arc Welding Electrode Holders. Until three years ago, Erico used a fiber handle which absorbed moisture, required special machining, had a tendency to warp and had a short service life.

In 1953 Erico switched to manufacturing their own handles and tip insulators, using Fiber Glass Chopped Strand in their reinforced plastic insulation material. This increased product life, produced a better and cooler handle, eliminated moisture absorption and lamination breakdown, and minimized warpage.

Erico insulators, reinforced with Fiber Glass Chopped Strand, offer exceptional high heat resistance and mechanical strength. Also the dimensional stability and light weight of fiber glass reinforced plastics result in the most modern insulation material available.

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You can gain these product advantages, too, with Pittsburgh Fiber Glass Chopped Strand. Let us show you how—right in your own plant. Contact our executive offices or one of the sales offices listed below for technical consultation.

Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Penna.

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The Plastiscope

Cryovac packaging materials and equipment.

The bags are intended for airtight, moistureproof packaging for sliced food products sold in consumer-sized units. They are said to have all the advantages of laminated pouches but none of the disadvantages, such as delamination, stiffness, and poor adhesion.

Non-burning vinyl sheeting

Rigid vinyl metallized plastic sheeting that will not burn has been developed by Gomar Mfg. Co., 79 Paris St., Newark, N. J., and is being marketed under the name of Metalcote. When placed in a flame, it shrivels but does not flare or explode. The non-burning quality of the sheet is particularly important for vacuum formed display pieces, toys, Christmas ornaments, and the like, where flameproofness is essential.

According to the company, Metalcote can be vacuum formed in both shallow and deep shapes. It is already being used for the manufacture of Christmas ornaments and displays for this year's Christmas season. It is available in continuous rolls in 0.005 gage.

Mass production of reinforced plastics

A new type of press and mold, capable of mass production of large reinforced plastic shapes by a process which makes void-free moldings with equipment claimed to cost less than that used in any other method, has been developed by Sterling Precision Corp.'s Fibre Glass Plastics Div., Toledo, Ohio. The new technique in principle is equivalent to metal-die molding but is reported to be free of the physical limitations in tool cost and production methods inherent in the process and to make fabrication of large and complicated shapes economically possible.

Parts of practically unlimited size and depth of draw are said to be possible, and close dimensional tolerances and uniform physical integrity throughout a structure can be maintained. Heretofore, consistently void-free moldings have not been possible in rapid, matched-die production. Automobile tops and trailer bathtubs are already being molded by the new Sterling method, details of which will be presented in a forthcoming issue of MODERN PLASTICS.

The company plans to build the presses and molds and sell and license use of them to plastic fabricators in the United States and other countries.

Caprolactam producer

Production of caprolactam-type nylon in the United States will be started by Foster Grant Co., Inc. in a new \$1 million plant at Leominster, Mass., built for that purpose. Capacity of the new facility, which is expected to be completed by the spring of 1957, is anticipated to be over 2 million lb. a year. This expansion is the second to be announced by Foster Grant within two months.

The original 24 million-lb. styrene monomer plant now is a 60 million-lb. plant and is claimed to have cost less than \$5 million. The company's original polystyrene polymer plant capacity at Leominster was increased in 1952 to supply material beyond the company's own needs for molding material, tripled in 1954, and now has been doubled. New high-flow and high-impact formulations have been added to its general-purpose compounds. In addition, the company compounds cellulose acetate molding material from flake and designs and builds more than 70% of its molding dies.

A good grip

A liquid plastic which, when applied to the fingers, will give a tight grip on articles to be handled by hand, has been put on the market by Miami Products Co., Fort Wayne, Ind. Tradenamed Grip-Aid, it is useful for those who handle slippery or polished articles and can also be applied to tool handles, golf clubs, and the like. One short case history cited by the producer: five assemblers in a plastics plant who cemented parts together upped the number of units handled in a week from 300 to 1500 by using Grip-Aid.

Resin for decontamination

Ion exchange resins may be used in the future for removal of radioactive contaminants from water, according to the Sanitary Engineering Branch of the Corps of Engineer's Research and Development Laboratories, Fort Belvoir, Va.

The method consists of removing the radioactive contaminants from the water by the addition of commercially available ion exchange resins. Attracted to the resins, the radioactive ions settle out with them after the solution has been agitated. It is claimed that the treatment will make water suitable for emergency drinking purposes in 30 minutes.

Lubricant in aqueous form

Designated Dispersion 33, an aqueous suspension of a high-melting, non-toxic, synthetic wax, has been developed by The Baker Castor Oil Co., 120 Broadway, New York, N. Y. It can be used as a mold release agent on heated molds, where it is claimed to be more effective than silicone spray both in mold release properties and in permitting a greater number of runs before mold relubrication.

Dispersion 33 may be incorporated in synthetic resin emulsions, rubber and vinyl latices, and other water-based systems for anti-blocking, anti-tack, oil resistance, and other properties.

Pipe notes

Ninety-eight miles laid. Believed to be the longest of its kind in the country, a 98-mile Kralastic styrene alloy pipe line has been installed in west Texas to carry fuel to 200 irrigation pumps. The pipe, buried 3 ft., cuts across fields and runs along fence lines in a series of branches, ranging up to 15 miles long, linking the pumps with a main pipe line carrying natural gas.

Kralastic is produced by the

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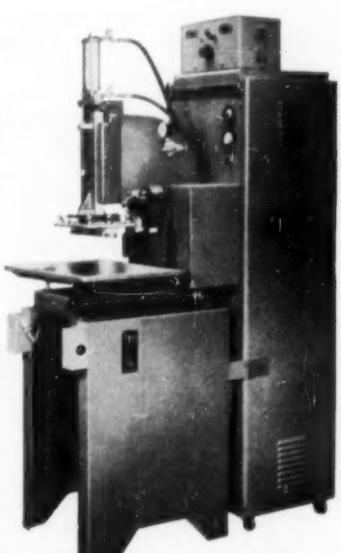

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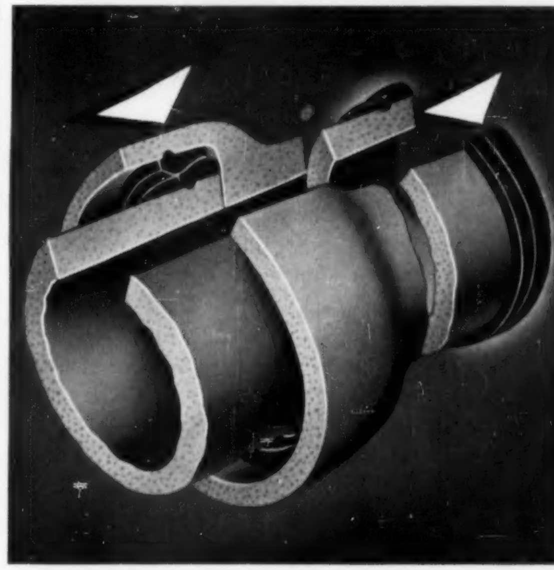

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Our R 5209 Tile Red **chem-o-sol** has been tailored to meet the exacting requirements of this in-plant molding operation. Its fast-fusing property allows for easy stripping of the molds and practically eliminates scrap losses. A complete specification sheet is available on request. (Base **chem-o-sol** will be matched to other shades if so desired.)

R 5209 **chem-o-sol** has the required hardness characteristics over a wide temperature range and exhibits outstanding heat resistance. It is available in drums and tank wagons from our new streamlined plastisol manufacturing facilities. Your request for further data or samples will receive our immediate attention.

*Patents pending by The Robinson Clay Product Co. T.M. Registration Applied For

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The Plastiscope

Naugatuck Chemical Div., United States Rubber Co. The pipe, formed into 30-ft. lengths by Republic Steel Co., was installed in 31 working days.

Nylon pipe. Availability of Tempertube nylon pipe has been announced by The Danielson Mfg. Co., Danielson, Conn. The pipe is supplied in straight lengths or continuous coils in sizes from 3/8 to 1 1/2 in. O.D. with wall thicknesses from 0.025 to 0.125 inch.

When compared with other plastics pipe of comparable dimensions, Tempertube is claimed to provide greater bursting strength, higher heat resistance, non-toxicity, and ease of assembly with commercial fittings. It is competitive in price with copper.

Standard proposed. The Commodity Standards Division of the U. S. Dept. of Commerce has presented for consideration by the industry recommended Commercial Standards covering dimensions and tolerances for rigid polyvinyl chloride pipe and solvent-welded cellulose acetate butyrate pipe.

Both specifications were proposed by The Society of the Plastics Industry, Inc. and have been adjusted in accordance with comment from other interests. If they are endorsed by a satisfactory majority of the industry, they will be issued by the Dept. of Commerce as Commercial Standards for voluntary use by the industry.

Copies may be obtained by writing to F. W. Reynolds, Commodity Standards Division, U. S. Dept. of Commerce, Washington 25, D. C.

Cement for P.V.C. pipe. Latest industrial application of VC-2 vinyl cement is the bonding of rigid polyvinyl chloride pipe for use in such underground installations as sprinkler systems and irrigation projects. According to Schwartz Chemical Co., Inc., 326 W. 70th St., New York, N. Y., maker of the adhesive, the pipe can be joined together as soon as the cement is applied. It dries in 10 to 15 min., at which time the bond becomes impervious to water.

Rigid P.V.C. pipe. Designated Riviclor, a line of unplasticized polyvinyl chloride pipe now being extruded by American Hard Rubber Co., 93 Worth St., New York, N. Y., is said to be resistant to a long list of chemicals, including many troublesome organics. Impact strength is as high as 2.5 (Izod).

Riviclor pipe and fittings are now available in sizes from 1/2 to 2 in., standard or extra heavy wall construction (Schedules 40 and 80 IPS). Working pressure of the 1/2-in. extra heavy pipe is 490 p.s.i. and the 2-in. pipe 255 p.s.i. at 70° F.

Expansion

Koppers Co., Inc. has purchased a 176-acre tract of land near Monroeville, Pa., for a new multimillion dollar research center. At present, the greatest part of its research work is being carried on at the company's Verona, Pa., research center. Transfer of facilities from Verona to the new center is expected to extend over a four-year period. Construction of the first building, a chemical laboratory, is scheduled to begin in 1957.

Thermel, Inc., manufacturer of electrical heating units for extruders and forming machines, has moved from 3440 W. Lake St., Chicago, to its new 10,000-sq. ft. factory and office at 9400 Robinson Rd., Franklin Park, Ill.

Standard Insulation Co., 74 Paterson Ave., East Rutherford, N. J., has expanded its office and warehousing facilities. The additional warehousing space will be used for closure lining materials and specialty coated fabrics manufactured by the company. Special cold storage areas are provided for the new line of Stanpreg preimpregnated materials supplied to the reinforced plastics and laminating industries.

The Glastic Corp., 4321 Glenridge Rd., Cleveland, Ohio, has enlarged its floor space and manufacturing facilities by approximately 50 percent. This addition marks the third major expansion in the company's 10-year history. Glastic produces glass-reinforced plastics electrical insulating materials.

Monsanto Canada Ltd. will construct a new synthetic resin plant at Clover Bar, Alberta, just outside of Edmonton. This will be Monsanto's third manufacturing plant of this type in Canada—the other two are located in Montreal and Vancouver. The Edmonton facility will primarily make liquid resin adhesives for the plywood industry of western Canada. Full-scale production is expected to start late this year.

Logo, Inc., Chicago, Ill., has completed a plant expansion program involving the addition of over 7000 sq. ft. of plant, office, and research laboratory space. A new 3500-sq. ft. building has been erected and equipped at the plant site for use as a paint blending room. Offices and research laboratories formerly located at the plant site have been moved to the Calument Harbor Terminal Bldg. at 130th St. and Stony Island Ave., Chicago.

American Molding Co., San Francisco, Calif., plastics custom molder, has broken ground for an enlarged $250,000 plant on a 6-acre site at San Leandro, Calif. The new building, which will double the firm's present capacity, includes administration offices, tool room, and facilities for injection, compression, and transfer molding.

Continental Carbon Co., an affiliate of **Witco Chemical Co.,** has opened a new carbon black plant at Eunice, N. M., with an annual capacity of 25 million pounds. The

(*To page* 253)

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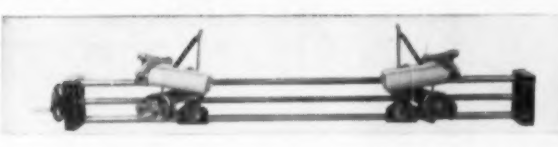

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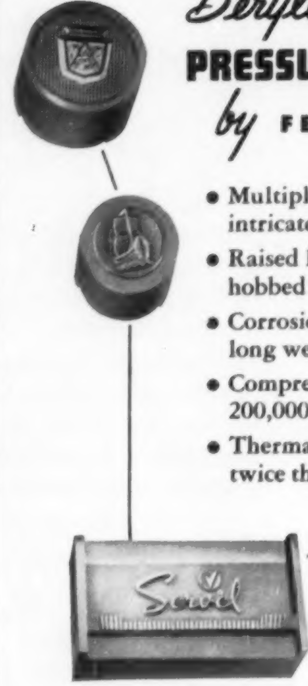

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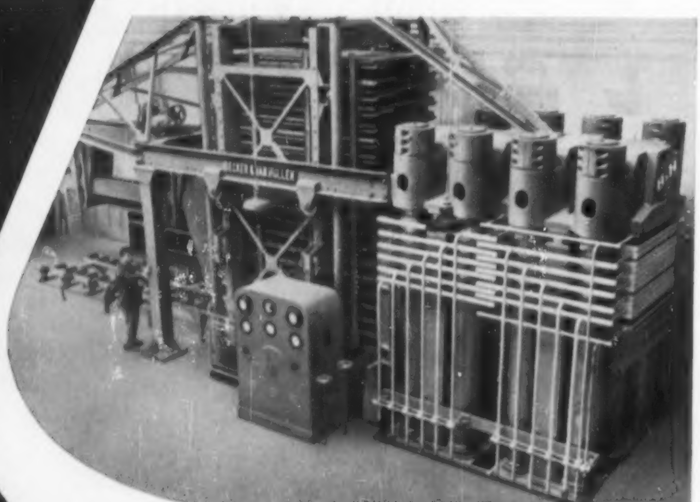

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How to Catch a Fisherman

It's said that fishermen buy more things than fish do. Be that as it may, the spinning tackle box by UMCO Corporation of Minneapolis, made of tough, versatile U. S. Royalite, illustrates some of the many advantages of this fine fabricating material. For Royalite is:

1 **Impact Resistant.** Tackle boxes are often banged against rocks or dropped into boats. Royalite can "take it".

2 **Rustproof.** Salt water or fresh, Royalite is completely unaffected. These spinning tackle boxes are often used by skin divers to carry equipment.

3 **Easily Fabricated.** Note molded-in lure compartments and sharp detail. Low-cost wood, resin or metal tools do the job, depending on volume.

4 **Compatible with Metal.** Note the aluminum plate, hinged to the Royalite. The latch fastens to the Royalite. The hinges, handles and buckles are riveted permanently in place.

Royalite is also: . . . *impervious* to most chemicals . . . *lighter in weight* than any commonly used metal . . . *beautiful*, in a wide range of colors and finishes . . . compounded of *plastic* fortified with *rubber* for superior impact resistance.

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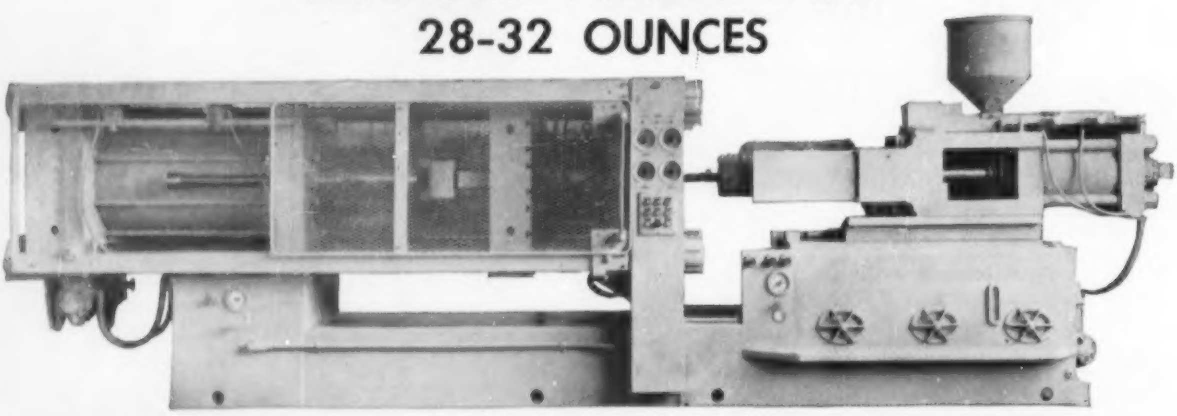

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Plasticizing Capacity..................275 lbs. per hour
Injection Plunger Speed.................175" per minute
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new facility will bring Witco's total capacity of all grades of carbon black to approximately 300 million lb. annually. One of the applications of carbon black is in polyethylene electrical insulation where it prevents degradation from sunlight.

Plastic Molders Supply Co., Inc., Fanwood, N. J., producer of colorants for thermoplastics, has expanded its activities to become a distributor for American Cyanamid Co.'s Laminac polyester resins in New Jersey, Delaware, Maryland, Pennsylvania, and metropolitan New York.

The company will also distribute Celanese's Marco polyester resins in all the above areas, except Delaware.

Plastic Molders has also added the following distributors for its own PMS color paste dispersions for polyester and epoxy resins: Plas-Tex Co., Inc., Fort Worth, Texas; Waldor Enterprises, Ltd., Montreal, Que.; Fiberlay, Inc., Seattle, Wash.; B & B Distributing Co., Miami, Fla.; Cadillac Plastic & Chemical Co., Detroit, Mich.; and Kristal Kraft, Palmetto, Fla.

National Starch Products Inc. has doubled its production capacity of polyvinyl acetate polymers at the Meredosia, Ill., plant. The expansion program was started early last fall to meet demands from the paint, adhesive, textile, and paper industries.

Polyvinyl acetate emulsions and adhesives compounded from these resins are also produced at Meredosia, as well as at the Plainfield, N. J., plant.

Durethene Corp., a subsidiary of **Koppers Co., Inc.,** has started production of polyethylene film in its new plant at 7000 W. 60th St., Chicago, Ill. Established eight years ago, Durethene now has two plants in Chicago and one in Los Angeles. The company also announced some time ago the addition of treated sheeting to its line. The executive and sales offices have been moved to the new facility from 1859 S. Fifty-fifth Ave., Cicero, Ill.

Meetings

Plastics groups

October 11-12: The Society of the Plastics Industry, Inc., New England Section Conference, The Wentworth Hotel, Portsmouth, N. H.

Other meetings

August 26-30: National Association of Furniture Manufacturers, Supply, Equipment, and Fabric Fair and Twenty-eighth Annual Convention, Conrad Hilton Hotel, Chicago, Ill.

September 9-12: American Institute of Chemical Engineers, Meeting, William Penn Hotel, Pittsburgh, Pa.

October 21-24: Society of Industrial Packaging and Materials Handling Engineers, Eleventh Annual Protective Packaging and Materials Handling Exposition, Kiel Auditorium, St. Louis, Mo.

October 22-26: National Industrial Exposition and Management Conferences, Detroit Artillery Armory, Detroit, Mich.

October 31-November 2: Society for Experimental Stress Analysis, Annual Meeting and Exhibit, Deshler-Hilton Hotel, Columbus, Ohio.

November 6-8: Packaging Association of Canada, Fifth Canadian National Packaging Exposition, Automotive Bldg., Canadian National Exhibition Grounds, Toronto, Ont.

Nov. 22-Dec. 3: Society of Industrial Chemistry, Assembly of Chemical Arts, Including Special Sessions on Plastics Materials and Rubber, 28 rue Saint-Dominique, Paris 7ᵉ, France.

"I'm from Missouri, Man!"

Pete: "So I ask you for a container with walls half as thick and twice as strong . . . and you give me polyethylene!"

Joe: "Cool off, chum. I give you GREX . . . which is about as different from ordinary polyethylene as brandy is from beer."

Pete: "I'm still from Missouri. Where's the big difference?"

Joe: "Well, take ordinary polyethylene. There, the polymer chains are sort of helter-skelter, so the resin tends to be soft . . . not particularly stiff or tough. GREX, on the other hand, is a *linear* polyethylene. The straight chains, like the ones behind the GREX trademark, are lined up almost parallel to each other and they're closely packed together, with fewer spaces between. So the resin is firm . . . rugged. And you can make a thin wall that's really strong."

Pete: "How about heat resistance? Any improvement there?"

Joe: "Sure . . . because these tightly-packed molecules in a *high-density* polyethylene aren't so easily disturbed. Matter of fact, you can actually boil a container made of GREX. Steam-sterilize it, too. At the other end of the scale, you can take it as low as 180° below zero without any trouble!"

Pete: "Sounds better all the time!"

Joe: "There's more to it than that . . . but wait till you see the samples!"

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Typical Analysis
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	80	Trace
100		96.0
120		65.2
140		48
170		36.4
200		22

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WWF

Wilner Wood Products Co., Norway, Me.

Company Notes

General Electric Co.: Boyd W. Bullock, formerly manager of decorative product sales, named manager of marketing of the Laminated and Insulating Products Dept. at Coshocton, Ohio. **Russell R. Menard** now manager of marketing administration of the Plastics Dept. at Decatur, Ill., responsible to marketing manager for administration and control of marketing services. **Dr. Arthur M. Bueche** appointed manager of a newly created unit in the Chemistry Research Dept. of the research laboratory at Schenectady, N. Y.

Allied Chemical & Dye Corp.—National Aniline Div.: C. L. Martin promoted to superintendent of services and **Robert L. Axtell** superintendent of production at the Moundsville, W. Va., plant. Among the company's new products are the Nacconate diisocyanates, adipic acid, and cyclohexanone.

Solvay Process Div.: John C. MacLeod to assistant director of operations. **Bennett D. Buckles** named assistant to the vice president. **H. W. McNulty** appointed technical assistant to the manager of the Organic Chemicals Section. **T. W. Reed** becomes technical assistant to the director of product development.

National Vulcanized Fiber Co.: Russell S. Davis, Jr. is new district manager of the Newark, N. J., office and **Charles J. Williams** district manager of the Rochester, N. Y., sales office.

Interchemical Corp. has acquired the industrial adhesives business of **Angier Products, Inc.** The acquisition involves the transfer of Angier's manufacturing facilities and other properties in exchange for Interchemical stock. Angier will operate as Angier Adhesives Div. of Interchemical with its present management and staff. **Henry S. Bothfield,** president of Angier, will be division president of the new Interchemical unit.

Angier is a manufacturer of industrial adhesives with plants in Cambridge, Mass., and Huntington, Ind.

Gomar Mfg. Co.: Twinpak, Ltd., of Montreal and Toronto, appointed Canadian representative. Gomar makes continuous roll and sheet plastics, plastic laminates, metallized acetate and butyrate in continuous rolls, and sheets for vacuum forming.

Aries Laboratories, Inc.: New production and technical service facilities set up at 45-33 Davis St., Long Island City, N. Y. The firm is engaged in epoxy resin formulations and specializes in casting and embedding of electrical components. **Murray Goldfinger** has joined the development and technical service laboratories as a chemist.

Celanese Corp. of America: Great Western Chemical Co., Inc. named distributor for Marco products and polyester resin in the Northwest and Oregon.

The General Tire & Rubber Co., Inc., Respro Div.: Sommers Plastic Products Co., 7 W. 18th St., New York, N. Y., named distributor of Resproid vinyl to the handbag, belt, billfold, accessory, and novelty fields in all areas except New England and the West Coast.

Firestone Plastics Co.: Ernest T. Handley, appointed executive vice president, has been vice president in charge of production and continues as general manager. **Kenneth L. Edgar** now vice president in charge of Velon sales and **Frank J. Groten** vice president in charge of chemical sales. Mr. Edgar and Mr. Groten were formerly sales managers for Velon films and filaments and Exon vinyl resins, respectively.

Canadian Industries, Ltd., Plastics Div.: Malcolm Wilkinson, formerly Toronto district sales manager, now assistant sales man-

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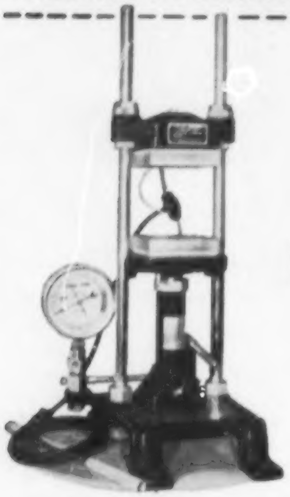
Standard for Research and Development



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Company Notes

ager—commercial; **Douglas E. Ferguson** succeeds Mr. Wilkinson; **J. Ian G. Bell**, formerly sales development manager, assistant sales manager—technical; **Lloyd A. Meredith** becomes Montreal district sales supervisor.

Northern Industrial Chemical Co.: G. Victor Sammet, president, and **Barthold E. Schlesinger**, treasurer, have retired from active management. They founded the firm in 1908.

New officers elected for the coming year include **Albert B. Bower**, president; **Hans H. Wanders**, vice president; **Phillip H. Seaman**, president of Executone, Inc., New York, N. Y., vice president; **G. V. Sammet, Jr.**, production manager; **J. B. Eliot**, treasurer; and **W. S. Ewell**, clerk.

Elm Coated Fabrics, Co., Inc. has moved its sales office and showroom from 48 W. 25th St. to 261 Fifth Ave., New York, N. Y. The Converting Dept. and inventory maintained at the previous location has been accommodated by a new 60,000-sq. ft. extension to its plant at 220 Stewart Ave., Brooklyn, N. Y.

Electric Storage Battery Co., Stokes Molded Products Div.: Thomas E. Wallis named general sales manager and **John A. Jackson** sales manager—plastics.

Rambach Chemical Co. has moved from 1170 Broadway, New York, N. Y., to 93-03 Sutphin Blvd., Jamaica, N. Y. The firm trades in dyestuffs, pigments, resins, solvents, plastics, and allied materials.

Rubber Corp. of America has moved its general and sales offices from Hicksville, N. Y., to 225 Broadway, New York, N. Y.

American Society for Testing Materials: Rudolph A. Schatzel, vice president and director of engineering of Rome Cable Corp., Rome, N. Y., elected president for a one-year term. **Kenneth B. Woods**, head of School of Engineering and director of Joint Highway Research Project, Purdue University, elected vice president for a two-year term.

Barber-Colman Co.: Instruments, Inc., 122 N. Madison, P. O. Box 556, Tulsa, Okla., now exclusive representative for the sale of Wheelco industrial instruments and combustion safeguards in the Tulsa area.

American Insulator Corp.: Bart Attig again with the sales staff. **Maurice F. Lloyd**, with the company for over 20 years, is now sales representative for Ohio.

New sales office has been established at 319 W. Washington St., Ashland, Ohio.

Bakelite Co., a Div. of Union Carbide and Carbon Corp.: Dr. Marion C. Reed, with the company for 26 years, is now publications coordinator at the Bound Brook, N. J., plant, responsible for the promotion, planning, and participation of the Development Laboratories in Bakelite's technical publicity program. **Dr. C. Leon Parker** named a project leader for process development work associated with the bulk polystyrene pilot plant. **Dr. Arthur K. Ingberman** named project leader, responsible for fundamental resin studies in the reactive resin field. **Howard J. Abelow** transferred from the Bound Brook plant to the Ottawa, Ill., plant.

Society of the Plastics Industry, Inc.: Kenneth L. Edgar, vice president of Firestone Plastics Co., elected chairman of the Vinyl Processors Administrative Committee, which heads the Film and Sheeting Div. He succeeds **Bernard Mittman** of Elm Coated Fabrics Co. who retired. Mr. Edgar was also named chairman of the annual conference on Film, Sheeting, and Coated Fabrics to be held by S.P.I. in December.

Heyden Chemical Corp.: Simon Askin, president of Heyden, elected chairman of **American Plastics Corp.**, a subsidiary; **Walter J. A. Connor** elected president of American Plastics; **James K. Lindsay**, secretary-treasurer of Heyden, elected treasurer of

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Company Notes

American Plastics. American Plastics does injection molding, extrusion, and vacuum forming; fabricates reinforced plastics; and also handles casein-type plastics.

Owens-Corning Fiberglas Corp.: Phillip L. Williams appointed manager of Reinforced Plastics Engineering Development and **John S. McBride** technical manager of the Plastics Reinforcement Laboratory.

Nosco Plastics, Inc.: Ruben G. Kugel, formerly treasurer, to vice president and treasurer; **S. L. Potter**, formerly controller, to vice president and controller; **Paul C. Roche**, formerly sales manager, to vice president and sales manager; **Lewis Novick**, formerly production manager, to operations manager; **J. D. Stricker** to eastern seaboard sales engineer. Nosco is a custom molder.

F. J. Stokes Corp. is the new name of the company formerly known as **F. J. Stokes Machine Co.** The company makes injection machines, vacuum metallizers, tabletting machines, and a range of other products.

Reynolds Metals Co. has purchased the **Duplan Corp.** property in Grottoes, Va. The new plant, to start operations this fall with more than 300 employees, will produce certain plastics films not presently in the company's line.

American Molding Powder and Chemical Corp.: Michael Pisetzner elected vice president and general manager; **Herbert H. Goldmark** continues as vice president and general sales manager; **Roy A. Sorenson**, formerly with Nixon Nitration Works, is new production manager.

Escambia Bay Chemical Corp.: Robert U. Haslanger appointed president, succeeding **Kenneth G. Donald** who resigned to devote full time to his duties as vice president and treasurer of National Research Corp. **Dr. N. C. Robertson,** director of research, named vice president; he formerly headed the Petro-chemicals Dept. of NRC. **A. E. New,** previously with Carbide and Carbon Chemicals Co., director of the Technical Dept. in the Manufacturing Div., will be responsible for process design and engineering projects. Escambia is building a PVC resin facility to be completed this year.

J. E. Plastics Mfg. Corp.: Jules A. Gutterman appointed sales manager; **Arthur G. Ringlen,** chief engineer, will be in charge of converting the plant to automation; firm makes acetate containers.

Federal Tool Corp.: I. J. Hesley, Jr. named sales manager of the Advertising Specialties Div.; **N. R. Nielsen** now on the staff of the Premium Sales Div.

R. L. Kuss & Co., Inc.: Warren Simpson appointed chief engineer and **Kent Shaver** sales manager. The company makes plastics film and is also a fabricator.

The General Industries Co., Plastics Div.: W. E. Foster, formerly manager of the division, named to the board of directors. **Russ Smith,** former chief engineer, made director of engineering and **C. M. Norris,** formerly with American Insulator Co. for 30 years, chief engineer. **Norman Smith,** with the company for 20 years, and **Paul O'Dowd,** formerly with Continental Can Co.'s Plastics Div., named salesmen for the Ohio territory.

Food Machinery & Chemical Corp., Becco Chemical Div.: Frederick A. Gilbert, 21 years with the company, elected president, succeeding **Dr. Max E. Bretschger** who has retired. Becco makes peroxygen chemicals for use as catalysts in the plastics industry and has recently started producing epoxies.

Archer-Daniels-Midland Co.'s New York office, formerly in the Woolworth Bldg., now in the Transportation Bldg., 225 Broadway, New York, N. Y., will handle fatty acids and other chemical and foundry products.

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Applying resin to fabric woven of Garan Roving at the Ken-Craft Trailer plant.

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☐ **POLYESTERS AND THEIR APPLICATIONS** *by Bjorksten, Tovey, Harker and Henning.* The first comprehensive survey of the polyester field from raw materials to fabricated products. Text plus over 3,300 references cover almost every phase of the production and use of polyesters including saturated polyesters used in the production of fibers, films, elastomers and foamed plastics. 1956, $10.00

☐ **PLASTICS FOR CORROSION-RESISTANT APPLICATIONS** *by R. B. Seymour and R. H. Steiner.* Shows engineers how to select the right plastic for construction in corrosive atmospheres; the use of plastics as protective coatings, organic linings, chemical resistant mortar cements, casting resins, plastic foams, impregnants, industrial adhesives and reinforced materials. Plastics available for a specific application are compared in tabular form for quick, easy selection of the most suitable material. 1955, $7.50

☐ **PLASTICS ENGINEERING HANDBOOK of The Society of the Plastics Industry, Inc.** The most complete, best arranged information ever published on the design, materials, processes, equipment, finishing, assembly, testing and standards of plastics and plastic products. Entirely rewritten, this new edition of the famous SPI Handbook is almost twice its former size. Suppliers of raw materials will find a complete set of accepted standards and specifications. Designers and engineers will find new testing methods fully described. Users of plastics will welcome the standards for testing, rating, certifying and labeling plastic commodities. 1954, $15.00

☐ **FIBERGLAS REINFORCED PLASTICS** *by Ralph H. Sonneborn.* The first complete treatment ever published on reinforced plastics. Covers in full detail the resins and glass reinforcements used, molding techniques, inspection and testing, properties and design considerations. Provides all those concerned with reinforced plastics with valuable information never before available in one compact volume. 1954, $4.50

☐ **PLASTICS TOOLING** *by M. R. Riley.* Summarizes all the information, both published and unpublished, concerning the use of plastics in jigs and fixtures, metal forming dies, plastics-forming molds, die models and prototypes. Describes tools now made of plastics, resins used, how they are made, how long they last, what they cost, etc. 1955, $2.50

☐ **HANDBOOK OF BARREL FINISHING** *by Ralph F. Enyedy.* Covers every phase of barrel finishing from cleaning and deslugging to coloring, polishing and burnishing in step-by-step sequence. More than 150 complete specification sheets provide all the information necessary for finishing a large variety of parts. 1955, $7.50

☐ **EXTRUSION OF PLASTICS, RUBBER AND METALS** *by H. R. Simonds, A. J. Weith and W. Schack.* Offers for the first time a complete coverage of extrusion as an important processing operation. The first part of the book is devoted exclusively to the extrusion of plastics. Here, the versatility of the extruding machine as an industrial unit is fully described and the many applications of extruded plastics are discussed. The remainder of the book focuses attention on extrusion of metals and such materials as rubber, food products, ceramics, graphite and even ice. 1952, $10.00

☐ **PACKAGING ENGINEERING** *by L. F. Borell.* First to describe all packaging materials, their best uses, and methods employed by packaging engineers to obtain the most efficient results at lowest possible cost. Covers types of containers, machinery, package design, protection against deterioration, labeling, testing, and all other engineering and design aspects. 1954, $9.50

☐ **ADHESIVE BONDING OF METALS** *by George Epstein.* Shows how to determine if an adhesive-bonded joint would be advantageous, what type of adhesive to select, how to employ it, and how to design the joint for best performance. Covers the chemistry, formulation, and factors affecting the strength of adhesive bonds. 1954, $2.95

☐ **ENGINEERING MATERIALS MANUAL** *edited by T. C. DuMont.* Offers complete descriptive information and reference data on every engineering material of interest to industry, both metallic and non-metallic. Separate sections cover irons, steels, stainless steels, aluminum, magnesium, copper alloys, plastics, rubber, ceramics, several types of finishes and coatings, and many others. 1951, $6.50

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Personal News

E. D. Lutz promoted to manager, flooring distributor sales, for the Films and Flooring Div., **The Goodyear Tire & Rubber Co.**; he has been with the company since 1943.

Carl Fuller named purchasing agent of the **Textileather Div., The General Tire & Rubber Co.**

John Albert Smith appointed engineer in charge of semi-automatic presses of **Hull-Standard Corp.**, Abington, Pa.

James R. Addonizio appointed New York technical sales representative for the Synthetics Dept. of **Hercules Powder Co., Inc.**

Howard K. Nason, with the company since 1936, has been elected a vice president of **Monsanto Chemical Co.** He had been named general manager of the Research and Engineering Div. in April. Among other positions Mr. Nason had held were director of research of the Plastics Div. and director of development in the Central Research Dept. at Dayton, Ohio.

James F. Hall, Jr. now Chicago representative for Industrial Chemical sales of **Pittsburgh Coke & Chemical Co.**

J. K. Moffett, Jr. transferred to a sales development post for Petrothene polyethylene resins of **U. S. Industrial Chemicals Co., Div. of National Distillers Products Corp.**

Charles J. Smith, with the company for 26 years, appointed manager of manufacturing of **Bryant Electric Co.'s Plastics Div.**, a wholly-owned subsidiary of **Westinghouse Electric Corp.**

A. James Fisher appointed general sales manager of **Metal & Thermit Corp.**, producer of organosols, plastisols, and coatings.

Frank E. Robbins, Jr., former partner in the Washington, D. C., law firm of Beale & Jones, specializing in chemical patents, is continuing the private practice of patent law in Rochester, N. Y., in association with B. Edward Shlesinger.

Richard F. Nugent appointed manager of urethane foam sales and development of **Hewitt-Robins, Inc.**, Stamford, Conn.

Richard C. Burck, formerly development engineer, promoted to products development supervisor of **Mobay Chemical Co.**

E. P. Wenzelberger appointed supervisor of the Specialties Div. of **American Felt Co.**, Glenville, Conn., and will concentrate largely on the application of natural and synthetic lactices and elastomers to felt as well as the application of powdered and liquid resins to fibrous constructions of all types.

Gerald R. O'Shea joined **Federal Color Laboratories, Inc.**, Norwood, Cincinnati, Ohio, as vice president in charge of sales. Mr. O'Shea has been associated with numerous phases of the pigment and chemical industry for about 25 years.

James R. Davidson, former sales manager of Hoosier-Cardinal Co., appointed executive secretary of **Society of Plastics Engineers, Inc.**, Greenwich, Conn.

C. R. Megowen, president of **Owens-Illinois Glass Co.**, named to represent the plastics, clay, glass, and stone industries on the National Advisory Council for the national industrial exposition of new industrial products, methods, and research developments to be held in October at the Detroit Artillery Armory, Detroit, Mich.

John O. Tragard appointed industry manager of plastics and rubber for **Nucleonics Corp.**, Columbus, Ohio.

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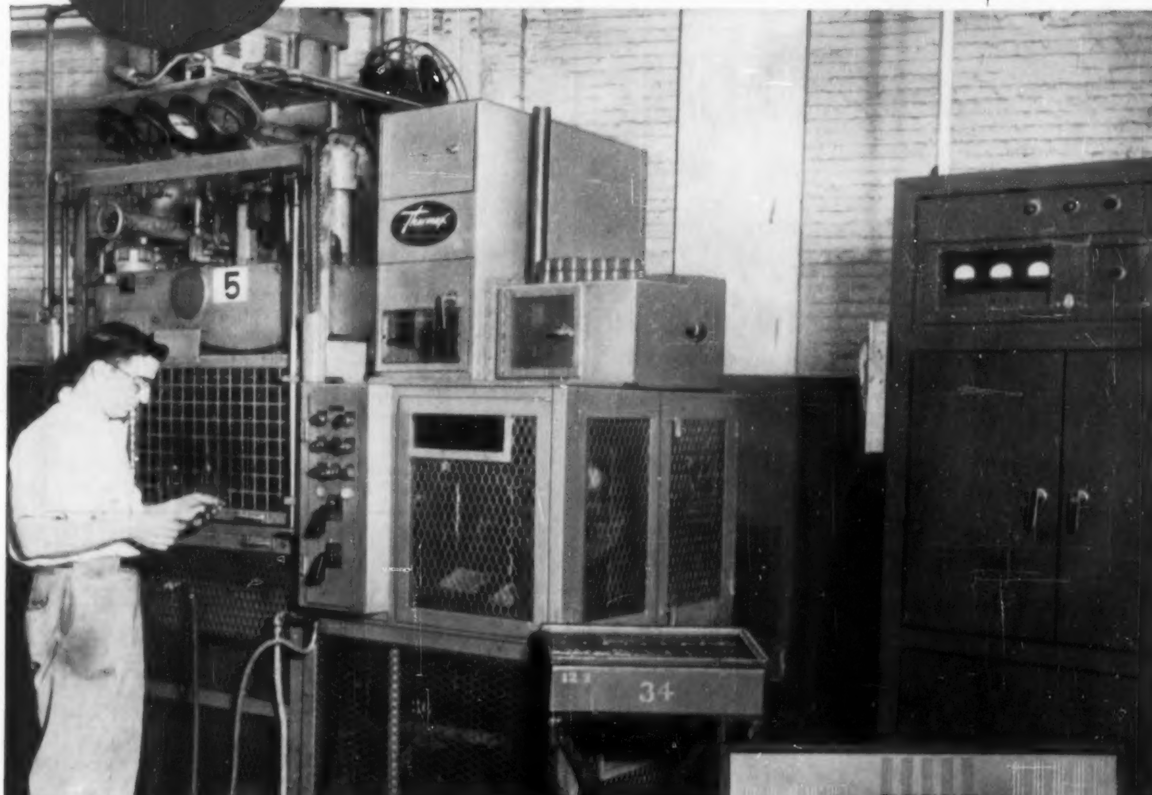

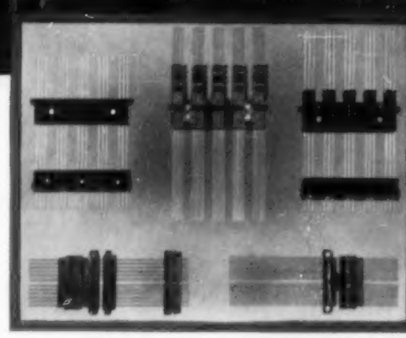

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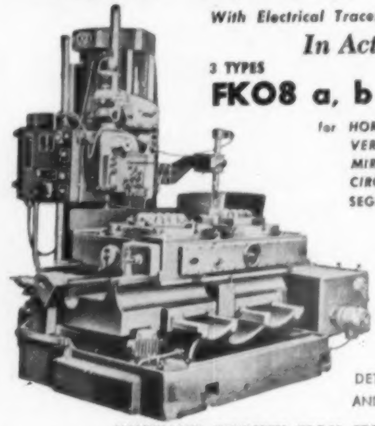

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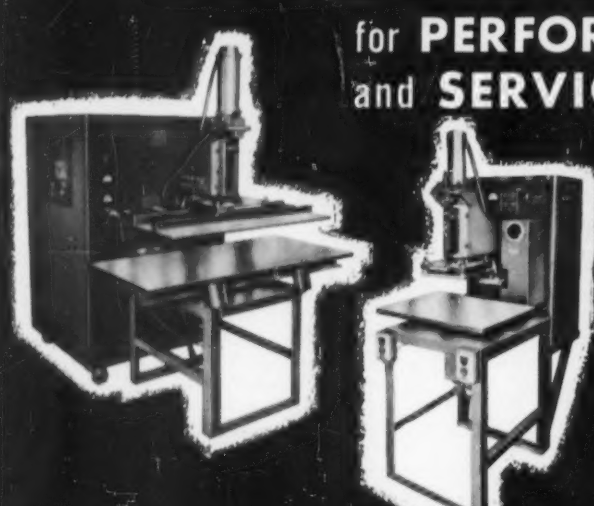

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VINYL GARDEN HOSE able to meet the challenge of sun and rain, alternate wetting and drying, provides another example of a product that benefits from a "tailor-made" Hercoflex plasticizer.

SHOWER CURTAINS that must be able to withstand soapy water and heat, provide longer service when the correct Hercoflex plasticizer is selected for the vinyl formulation.

No single plasticizer can meet all the varying requirements of vinyl processors. That's why the Hercoflex family was developed—to provide a versatile group, each member of which has its own specific properties to meet individual processing needs with "tailor-made" precision.

Whether you are seeking low temperature flexibility, the extreme of Hercoflex 290, the well-known premium performance of Hercoflex 150, or utility plasticizers at economical costs, you're sure to find a member of the Hercoflex family that fits the bill.

Major vinyl processors know that the Hercoflex family offers the opportunity to select the one plasticizer designed to do a specific job best. To find out more, write Hercules. Outline your requirements and we'll be glad to send technical data on the Hercoflex that meets your specifications.

HERCOFLEX®
VINYL PLASTICIZERS

Synthetics Department
HERCULES POWDER COMPANY
916 Market St., Wilmington 99, Del.

Classified Advertisements

Modern Plastics **reserves the right to accept, reject or censor classified copy.**

Employment

Business opportunities

Equipment

Used or resale only

Machinery and equipment for sale

FOR SALE: Vacuum Metallizer Stokes 36". Injection Presses: Reed 4, 8, 12, 24 ozs. HPM 4, 9, 16 ozs. Lester 8, 12 ozs. Lewis 4 oz. Van Dorn 1 & 2 ozs. Extruders: 4½" oilhtd. NRM, 2" steam htd. NRM Saran pipe setup. Conveyors. Ovens. Compression & Transfer Presses 50 to 600 T. Elmes Hydrolair 30 T. Preform-presses: Colton 5½ T. Cutler-Hammer 2KW Electr. Preheaters. Vacuum Form. Mach: Abbott Drape 36x40". Autovac 52 x 30." Day Mixer Size 0. All Midwest locations. List your Surplus Equipment with me. Justin Zenner, 823 Waveland Ave., Chicago 13, Ill.

FOR SALE: 60 oz. H.P.M. w/1200 ton clamp; 48 oz. H.P.M., 1955; 48 oz. DeMattia; 32 oz. Lester, 1950, $22,000; 16 oz. Mod. E. Reed-Prentice, 1948, $13,000; 16 Impco vert. w/10 oz. cyl, $7,500; 16 oz. H.P.M., 1946, $11,500; 12/16 oz. DeMattia, fully hyd., 1951, $10,000; 12 oz. DeMattia, $7,500, terms; 12 oz. Lesters; 8 oz. Reed-Prentice, 1946, $7,000; 9 oz. H.P.M. w/12 oz. cyl, 1945, $7,500; 8 oz. Lester, 1946, $5,500; 8 oz. Leominster, 1946, $3,500; 6 oz. Reed-Prentice 1946, $6,500; 4/6 oz. Reed-Prentice, 1955, w/low pressure closing, fully aut., $10,500; 4 oz. Lester, 1953, fully aut., $8,500; 4 oz. Watson-Stillman vert. 1949, $5,000; 4 oz. H.P.M. 1948, $4,500; 4 oz. DeMattia vert. new; 3 oz. Fellows, 1951; 2 oz. Reed-Prentice, $1,500; 2 oz. Isoma, fully aut., $1,500; 2¾ oz. Clifton, new, $3 350; 2½ oz. Moslo Minijector; used cylinders, grinders; Model F Packaging machine; Auto. spraying machine; Stokes presses; all types new and used plastic machinery—Let us list your surplus equipment. Acme Machinery & Mfg. Co., 102 Grove St., Worcester, Mass.

FOR SALE: Marco Process consisting of: Homogenizer, Roto-Feed Mixers, Reactors. Kom-Bi-Nators Pumps, all stainless steel. Heavy Duty Double Arm Sigma Blade Mixers. (2) Readco 50 gal. 30 HP; (2) W & P 100 gal; (2) J. H. Day 75 gal. stainless steel. (2) Kux Rotary Pellet Presses. (3) Sprout-Waldron Horizontal Ribbon Mixers 336 cu. ft. (12,000#) capacity. (1) St. St. Pug Mill 7" diameter x 3'9" long overlapping chambers, jacketed 75#. (4) Mikro Pulverizers #2DH, #2TH, #3TH. (3) Fitzpatrick Stainless Steel Comminuting Machines. Models D. K. & F. We Buy Your Surplus Equipment. Perry Equipment Corp., 1429 N. 6th St., Phila. 22, Pa.

FOR SALE: Slitter-rewinder, 52" wide, which has been handling cellophane and similar materials. Cameron, Model 24-7, Machine #133000, complete, purchased new 1943, excellent condition. Cotswold Fibres, Inc., Columbus, Georgia.

BARGAIN PRICES. Baker Perkins 50 gal. cap. stainless steel steam jacketed heavy duty Mixers with stainless jacketed blades, motorized power tilting, motor driven. W&P 200 gal. heavy duty Mixer, tilting type, with sigma blades. J. H. Day from ¾ up to 100 gal., Imperial & Cincinnatus D.A. jacketed, sigma blade Mixers. Day 15 to 10,000 lbs. Dry Powder Mixers. Gemco 2000 lbs. 56 cu. ft. Double cone Blender. Mikro Bantam, 1SH, 1F, 2TH Pulverizers. Day, Rotex, Tyler Hummer, Robinson, Raymond, Gayco, Great Western Sifters. Colton 2 RP & 3RP Rotary Tablet Machines. Carver Lab 20 ton hydraulic press. Package Machy. FA, FA2, FA4, Miller, Hayssen, Scandia, Hudson Sharp, Oliver Auto Wrappers—all sizes. This is only a partial list. Over 5000 machines in stock available for immediate delivery. Tell us your machinery requirements. Union Standard Equipment Co., 318-322 Lafayette St., New York 12, N. Y.

FOR SALE: Hartig 3¼" Plastic Extruder. VanDorn 1 oz. Injection Molding Machine. Stokes R, 2½", single punch, Preform Machine. Kux 2½" dia., single punch Preform Machine. Farrel 15"x36", 2-roll mill. Mills and Calenders up to 84". New Seco 6"x13" and 8"x16" Lab. Mixing Mills and Calenders. Plastic and Rubber Extruders. Oxford 57" Slitter. HPM 1200-ton Laminating Press, 15 openings, 100"x120". Brunswick 225 ton 21"x21" platens. Farrel 200 Ton 30"x30" platens. 200 ton Hobbing Press 18"x14" platens. D&B 140 ton, 36"x36" platens. W-S 150 ton Semi-automatic 24"x24" platens. D&B 150 tons, 24"x24" platens. Adamson 80 ton, 20"x20" platens. Farrel 200-ton 20"x80" platens. Southwark 30 ton 14"x14" platens, semi-autom. Also Lab. to 2000 tons from 12"x12" to 48"x48". Hydr. Pumps and Accumulators. Stokes Automatic Molding Presses. Rotary and single punch Preform Machines, ½" to 4". Injection Molding Machines 1 oz. to 60 oz. Baker-Perkins & J. H. Day Jacketed Mixers. Plastic Grinders. Gas Boilers. Partial Listing. We buy your surplus machinery. Stein Equipment Co., 107-8th Street, Brooklyn 15, New York. Sterling 8-1944.

STAMP-O-MATIC FOR SALE: We have a stamp-o-matic printing machine, model spc, for sale to best offer received. Will print up to 9 inches, excell. cond. Please write purchasing agent, Loma Plastics, Inc., P.O. Box 11277, Ft. Worth, Texas.

FOR SALE: 1—Royle #4 Extruder, motor driven; 1—6"x12" Laboratory Mill, m.d.; 1—Ball & Jewell Rotary Cutter, size O m.d.; 2—Baker-Perkins Size 15, 100 gal. Jacketed Mixers; 5—Horizontal Dry Powder ribbon Mixers, 4000#, 1500#, 500#; 1—New 3 Roll 6"x16" Laboratory Calender; 1—Farrel-Birmingham 60" Mill with reduction drive, 150 HP motor, floor level mounting; 1—Fitzpatrick "D" Comminutor, S.S. contact parts, jacketed; 1—Mikro Pulverizer #2th, with motor; 4—Reed-Prentice & W-S Injection Molding Machines, 2-16 oz.; Also other sizes: Hydraulic Presses, Tubers, Banbury Mixers, Mills, Vulcanizers, Calenders, Pellet Presses, Cutters. Send us your inquiries. What have you for sale? Consolidated Products Co., Inc., 50 Bloomfield Street, Hoboken, N. J. HOboken 3-4425, N.Y. Tel.: BArclay 7-0600.

FOR SALE: Lester Injection Molding Machines 4, 8, 12 and 16 oz.—W-S & Baldwin Hobbing Presses 150 to 2000 ton —Bolling Laboratory Presses 50 to 150 ton—Molding Presses & Pumps—new ¾" Hi-Speed Hydraulic 3000 psi Double Solenoid Hydraulic Control Valves—partial listing—we buy used plastic molding equipment. New 6"x12" M.P. Laboratory Mills. Plastic Machinery Exchange, 426 Essex Avenue, Boonton, N. J. Tel. DE 4-1615; Cable address "Plasmex-Boonton."

FOR SALE: Stainless Steel Rotary Dryer. Link Belt Co., 5'2"x16". No. 502-16, with all aux. equip. Roto louvre also 6'x24' and 5'x26'. Hersey Stainless Steel Rotary Driers. Reply Box 1202, Modern Plastics.

FOR SALE: 3—Ball & Jewell #2, #1½ Rotary Cutters; 1—Cumberland #0 Rotary Cutter; 4—Two Roll Mills 20"x22"x60", 15"x40", 6"x14"; 3—Baker Perkins 100 gal., 50 gal., 2 gal., jacketed double arm Mixers; 1—Stokes Rotary Preform Press #DDS2; 3—Stokes Model "R" single punch Preform Presses; 1—Kux Model 15-25 Rotary Press; Also: Sifters, Banbury Mixers, Powder Mixers, etc., partial listing; write for details; we purchase your surplus equipment; Brill Equipment Co., 2407 Third Ave., New York 51, N. Y.

FOR SALE: (2) 300 Ton W.S. Presses 20x20 & 29x24 Platens. 140 Ton W.S. 22x16 Platen. 85 Ton Waterbury Farrel 20x24 Platen. 63 Ton Press 15x15 Platen with Pullback Cyls. 9, 8, 4. Oz. Injection Molding Machines. 15 Ton Lab. Presses 10x8 Platen. 10 Ton Lab. Presses 6x6 Platen. Standard Mystic Embossing Presses, Accumulators, Pumps, Valves. 250 Ton W&S 28x24 Platens, 80 Ton Farrel 24x24 Platens. Many other Presses—Send for Bulletin. Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N.Y. Tel.: WAlker 5-8300.

NEW ARRIVALS FOR SALE: French Oil Mill Mchy. Compression Molding Presses: 75-170 tons, 3-170 tons, 35"x18", 5-95 tons 29"x18", 3-75 tons 18"x17", 5 Preheaters 2 KW, Wood 20"x20" 12" ram 170 tons; Southwark 24"x24" 12" ram, 170 tons; Baldwin Southwark 4-26"x26" 8" rams, 75 tons; 5-26"x26" 7" rams 57.7 tons; 2-15"x15" 8" rams 75 tons; 2-19"x24" 10" rams, 78 tons; 2-12"x12" 7½" rams 66 tons; 2-D&B 12"x12" 7" rams, 57.7 tons; 8"x9" 4½" rams, 24 tons; D&B 12"x12" 3" rams, 10 tons; HPM Transfer Molding 75 tons; Preform Presses, Colton 5½T Stokes R and DDS-2 MD; New Universal Dual Pumping Units 3-15 HP; Lab. Mills and Calenders; also Extruders, Mixers, Vulcanizers, Injection Molding Units, etc. Universal Hydraulic Machinery Co. Inc., 285 Hudson St., New York 13.

FOR SALE: (11) 75 ton record presses, complete @ $2,450, (11) new 100 ton, 10" ram, 10" stroke @ $1,100, (8) 200 ton, 9" stroke, 14" ram, 36x36 @ $1,850, (7) 200 ton, 9" stroke, 15" ram, 30x30 @ $1,650, (1) 50 ton complete, 18x18 @ $1,850, (1) 200 ton, 16" ram, 30x30 @ $2,450, (2) 200 ton, 16" ram, 42x42 @ $2,850, (1) 200 ton, 15" ram, 42x42 @ $2,450, (4) 250 ton, (2) 12" rams, 30x60 rebuilt @ $3,375. Hydraulic Sal-Press Co., Inc., 388 Warren Street, B'klyn, N. Y.

(Continued on page 266)

acryvin

BIG NEWS!

Acryvin's Newest Division is Now Producing

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Priced to compete with lowest-priced plastics

Cast sheets available in

- ACRYLIC
- ACRYLIC-POLYESTER
- POLYESTER

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- POLYESTER

From 1" diameter and up

COLORS: Clear. All transparent and opaque colors cast to your own specifications.

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A Division of Acryvin Corporation of America
6202 Avenue U, Brooklyn 34, N.Y.
TEL.: CLoverdale 3-6050

(*Continued from page 264*)

FOR SALE: Hydraulic Presses: BIRMINGHAM 2400 Ton Belt Press 65"x 25'6". 24—11" Rams. HPM 1200 Ton. 15 opng. 100"x120" STM. Platens, Slf.-cntd. ELMES 1000 Ton Hobbing, M.D. Pump. BALDWIN SOUTHWARK 800 Ton, 10-opng. 42"x42" STM. Platens. HPM 750 Ton, Down-Acting, 59"x44" bed, Slf.-cntd. MORANE 669 Ton, 3 Upmoving Rams, 16" stroke. FARREL 625 Ton, 52"x52" Platens, Slf.-cntd. WATSON-STILLMAN 600 Ton, Hobbing, M.D. Pump. FARREL 393 Ton, 2-opng., 48"x48" STM. Platens. ELMES 350 Ton, Down-Acting 30"x36" Bed. Slf.-cntd. LAKE ERIE 300 Ton, 30"x30" Platens, Slf-cntd., Semi-auto. LAKE ERIE 215 Ton, 36"x36" Platens, Slf-cntd., Semi-auto. CAREY 150 Ton. 21"x16" Platen, Adj. DLO 8"-28" (3). LAKE ERIE 100 Ton, Down-Acting, 24"x24" Bed, Hi-Spd., Slf.-cntd. FARQUHAR 100 Ton, Down-Acting, 30"x28" Bed, Slf.-cntd. FARQUHAR 100 Ton, Drawing, Down-Acting, 29"x34" Bed, Hi-spd., Slf.-cntd. HPM 100 Ton, Fastraverse, Down-Acting, 30"x30" Bed, Slf-cntd. WATSON-STILLMAN 100 Ton, Down-Acting, 22"x20" Bed, Slf-cntd. WATSON-STILLMAN 100 Ton, Burroughs 75 Ton, HPM 35 Ton Molding Presses. FARQUHAR 75 Ton Up-Acting 30"x42" Platens. BALDWIN-SOUTHWARK 50 Ton, Angle Molding Press. WATSON-STILLMAN 50 Ton, 12"x17" Elec. Htd. Platens. FARREL 50 Ton, 12"x 12". LOOMIS 40 Ton, 4 opng., 12"x12" Elec. Platens. FRANCIS 40 Ton, 4-opng., 12"x 12" Elec. Htd. Platens. BAKER 30 Ton Full Auto, 21"x26". WATSON-STILLMAN & ELMES 30 Ton & 20 Ton Lab Presses. STOKES Model 200D-2, 15 Ton Auto. & Stokes 300, 200, 150, 100 & 50 ton Semi-auto. Molding Presses, All Slf-cntd. LOGAN 5 Ton Twin Ram 7½ HP M.D. DENNISON 2 Ton Model DD2C61 Multi-press, Motor & Controls (5). Injection Machines: DE MATTIA, Model B 24 Oz. IMPCO 22 oz. Model VF 8-22. REED-PRENTICE, 10-E-16, 16 Oz. Machine. LESTER 12 oz. with Glengarry Weigh Feed. FELLOWS 8 Oz., 1951 Machine, Practically New. IMPCO, 8 Oz. Vertical Model VF-8, Late Model. WATSON-STILLMAN 6 Oz. WATSON-STILLMAN 4 Oz. HPM 2 Oz. Manual cntrl. NRK 2 Oz. Hand Optd. WATSON-STILLMAN 2 Oz. VAN DORN, Model H-200, 1 Oz. & 2 Oz. Tablet machines. STOKES S-5, 280-G, R-1, DD-2, DDS-2, RB-2, RD-4, RDS-3, R. T. & F. COLTON #5½, #5, #2-RP & #3-RP, KUX 64, Extruders: ROYLE 4½" Screw 60" Barrel Elec. Htd. Practically New 6" Screw 60" Barrel 4 Zone Elec. Htd. ROYLE Nos. 1, 2, 3, & 4; ALLEN-WILLIAM 8"—All Indiv. Motor Drive. HARTIG Converted 6" Oil Htd. Mills: FARREL 20"x22"x72" (2), Farrel 18"x50" (4), Farrel 16"x48" (3), Farrel 16"x40". Available as Mill Lines or as Individual Units. Rotary Cutters: FOREMOST 25 HP M. D. With Blower. CUMBERLAND No. 0, 2 HP M.D., VAN DORN 1 HP M.D. Model C-100. Ball & Jewell 1HP M.D., Stainless Steel, Ball & Jewell 1 HP M.D., Ball & Jewell ½ HP M.D. Calenders: Farrel-Birmingham 24"x48" Herringbone Gears, 50 H.P. D.C. Motor Drive. THROPP 15"x48" with M.D. American Tool 9"x48" Rolls Belt Drive. Mixers: Banbury No. 11, Bodies Only. Banbury No. 9, Bodies Only. Banbury No. 9, 200 HP Motor Drive. Banbury No. 3A, 150 HP M.D. Roller Coater: UNION Roller Coater, Model B-30-50 New 1952 up to 50" Material. Miscellaneous: Sturtevant Blenders: 1—#12 20,000 Lbs. Capacity, Practically New. 2—#10, 13,000 Lbs. Capacity, Never Used. STOKES Vacuum Impregnating Equipment. DESPATCH 3 Drawer & 8 Drawer Pre-heating Ovens. MEGATHERM 3 KW Pre-heating Ovens. LYDON 21 Drawer Pre-heating Ovens Motor & Blower (5). ROYLE 36" Capstan Take up. WATSON 30" Type D-C Take up. THERMONIC Dielectric Generator Model M-285. Vulcanizers, Grinders, Pumps, Valves, Platens, etc. Johnson Machinery Co., 683-P Frelinghuysen Ave., Newark 5, N. J. What have you for sale? BIgelow 8-2500. What are you looking for?

FOR SALE: Hydraulic flat bed press 50"x 100" mfd. by Merritt-Solem Mesco complete with all hydraulic and steam controls. Good condition. Immediate delivery. This machine can be equipped with hot plates for laminating or used for large plastic moldings. Also four 16" 500 ton hydraulic rams. Also French Oil Mill Four-Throw Four Plunger power pump. Used—Good condition. Dockery Manufacturing Co., Inc., Rockingham, N. C., Telephone 3040.

FOR SALE: Complete Compounding Line—Includes Banbury (5 Gallon) Struther-Wells, Mill, Conveyor, Water Bath, Blower, Pellitizer, Exhaust Fan Etc. Now Operating. Can be seen running. Also other Equipment. Reply Box 1229, Modern Plastics.

FOR SALE: Die-Temp Mold Temperature Controller, Model R42153-Serial 53-5001, complete with pumps, switches & 4,000 watts controlled heating element 3 phase, 60 cycle, 220 volts, used very little. Reasonably priced. Kiddie Brush & Toy Co., Jonesville, Michigan, Phone VIctor 9-6351.

FOR SALE: (1)—37"x37"—10 opening hydraulic press, 30" ram; (4) Adamson 20x 20" presses, 15" rams; (1) Wood 30 ton 15x15" self-contained molding press; (8) Cumberland #1½ granulators, 3, 5 HP; (3) Carver 10 ton electric lab presses; also mills, mixers, extruders, etc. Chemical & Process Machinery Corp., 52 Ninth St., Brooklyn 15, N.Y.

Machinery and equipment wanted

WANTED: Twin Screw Extruder, 2½ to 3 inch, preferably Welding Engineers make. Advise full details: Erie Plastics Company, P.O. Box 1068, Erie, Pa.

WANTED: One 1¼" or 1½" used extruder. Reply Box 1203, Modern Plastics.

WANTED: To Buy; 1 oz. Hand operated Model #1 Molder, Van Dorn Injection Press, Model H 200 two oz. (Standard) Van Dorn power operated press, or similar machines. Small scrap grinder. Novelty & housewares molds. Must be in good condition & reasonable. Send complete information & prices to Collins Products, Box 465, North Hollywood, California.

Materials for sale

FOR SALE: We are authorized to sell for a Plastic Button Company (now liquidating) approximately 35,000# of Urea & Phenolic Molding Powders made by Plaskon & Bakelite, various colors & packed in original factory containers. Will sell lot at .09¢ lb., F.O.B. Detroit. Write for list of colors & grades. Globe Trading Co., 1815 Franklin St., Detroit 7, Michigan.

FOR SALE: Reprocessed cellophane flake. Carload quantities available. Price list upon request. Clinton Pallet Co., Inc., 615 South First St., Clinton, Iowa.

Materials wanted

WANTED.
Plastics Scrap and Rejects of all kinds. Ground and unground. Also rejected molded pieces and surplus virgin molding powders. Top prices paid.
A. Bamberger Corporation
703 Bedford Ave., Brooklyn 6, N. Y.
MAin 5-7450

WANTED: Plastic Scrap. Polyethylene, Polystyrene, Acetate, Acrylic, Butyrate, Nylon, Vinyl. George Woloch, Inc., 601 West 26th Street, New York 1, N. Y.

Molds for sale

FOR SALE: Complete line of Houseware Molds, Comb Molds, also some novelty and specialty items. No reasonable offer refused. Send for list. Reply Box 1213, Modern Plastics.

FOR SALE: Hobby Horse Mold. Horse is 20" high, 50" long, molded in two pieces with two legs assembled on. Mold is 50" x54"x14". It was used on polyester glass and macerated phenolic. Reply: Capac Industries, Inc., Capac, Michigan.

FOR SALE: A number of Compression Type Plastic Molds, to produce Ashtrays, Cigarette Caskets, Household Articles, Lipstick Cases, Flapjacks and Fancy Goods, etc. All Molds in good condition. A once-in-a-lifetime bargain for an estab. manufacturer, or a rare oppty. for someone entering the manufacturing field. Write for complete information. Reply Box 1230, Modern Plastics.

Molds wanted

ARGENTINA: Important injection and compression molder seeks collaboration with American molder for exchange and/or lease of molds. Principal will be in New York shortly. Please reply in full confidence to Box 1215, Modern Plastics.

WE BUY used molds to use on bakelite stocks press, 150 tons, to produce electric fixtures as fluorescent lampholders, starters sockets, keyless fixtures sockets, wall plates, plug caps, plug bases, etc. Our address is Lux, S. A. Apartado 1510 Monterrey, N. L. Mexico.

COMPRESSION TYPE: molds wanted for cafeteria trays—silver boxes—dish ware and tote boxes. One mold or complete line. Must be in good condition. Camfield Fiberglass Plastics, Inc., Zeeland, Mich.

Help wanted

EXTRUSION ENGINEER: Midwest-AAA-1. Experienced in die design, extrusion techniques, production and fabrication of custom profiles in rigid and flexible vinyl, nylon, and polyethylene. Please send resume of experience, education, references and salary requirements in first letter. Reply is held confidential. Reply Box 1227, Modern Plastics.

(*Continued on page 268*)

CHEMICAL ENGINEERS or CHEMISTS

. . . for process development work in aircraft, plastic parts and tooling. Must have experience in reinforced plastics, read blueprints, design parts and tools. Knowledge of polyesters, epoxies, phenolics helpful. Development work in non-metallic materials useful. The ability to carry assignments through development stage into production is essential.

Pleasant working conditions and stimulating atmosphere. Republic is known throughout industry for its liberal benefits and free family-employee hospitalization and insurance provisions, plus its now-famous 2-Fold Retirement Income Plan.

Please send complete resume to:

Mr. Charles J. Ketson
Employment Manager

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(Continued from page 266)

POLYMER RESEARCH.
Group Leader, Polymerization Chemist, Compounder, permanent positions available in expanding polymer research program of national chemical company. Industrial experience in field of fluorine polymers desirable but not essential. Excellent facilities and pleasant working conditions in Suburban Philadelphia Laboratories. Please send resume of personal data, education, experience, and salary requirements to:
Pennsalt Chemicals,
Business Manager, Technical Div.,
P.O. Box 4388, Phila., 18, Pa.
Your correspondence will be held in strict confidence.

EXTRUSION FOREMAN: to supervise second shift. Progressive plant in western Pennsylvania doing custom profile work in vinyl and butyrate. Will make very attractive offer to right man who can translate blueprints and instructions into high quality finished products. Reply with complete details to Box 1226, Modern Plastics.

WANTED: Semi-experienced and experienced mold designer. Permanent positions for the right men, in the Newark, New Jersey area. Reply stating experience and salary requested to Box 1225, Modern Plastics.

FOREMEN, VIRGINIA LOCATION: Plastic Extrusion Sheet. Excellent opportunity for expd. extrusion men in our expanding plastic sheet dept. Must be mechanically minded. Attractive pay, liberal benefits, warm climate, friendly community. No housing problem, relocating expenses will be paid. Write letter giving background and past experience to President. Replies kept confidential. Reply Box 1224, Modern Plastics.

SALES ENGINEER: Vinyl Resins and Compounds. Basic chemical manufacturer offers unusual opportunity for man with experience in sale of vinyl resins and specialized compounds. New vinyl resin plant for production of specialized resins and compounds will go into operation late this year and opening exists for capable man who can grow with the expanding organization. Excellent pension plant. Salary open. Request recent photo with letter outlining background and experience. Address reply to Box 1221, Modern Plastics.

PLASTICS ENGINEER: Established custom injection and compression molding plant requires ambitious, aggressive engineer familiar with molding processes, tool layouts, quotations and estimates. Ability to carry assignments through development stage into production. Plant conveniently located in metropolitan New York City area. All replies will be held confidential. Reply Box 1209, Modern Plastics.

WANTED: By old established plastic molding firm upstate New York capable man thoroughly experienced in compression, transfer and injection type molding, tool experience essential. Excellent opportunity. Replies held in confidence. Send resume covering education, experience, references and salary desired to Box 167, Albany, New York.

PETROCHEMICAL MARKET: Development. Petrochemical Department of major oil company planning diversification and expansions into new fields including plastics. Need man with sound knowledge of processes, applications, customer service and several years' experience in selling and development of new markets for one or more types of plastics. At present do not manufacture any plastic but have raw materials sources. To qualify for this position, the applicant must be able to assume a major role in guiding the company into the plastics field. This is an unusual opportunity to get in at the start of diversification program, to help in selecting the most promising products to manufacture and market and to assist in building up a technical service and selling organization. Location, Houston, Texas. Salary open. Please send detailed resume of education and experience to Box 1223, Modern Plastics.

REINFORCED PLASTICS ENGINEER.
Prefer man with chemical engineering background or mechanical engineer with experience in design and manufacture of reinforced plastics for work in development and project engineering government and civilian products. Midwest location. Write giving full particulars, including salary requirements, in first letter.
Box 1231, Modern Plastics.

NEW YORK COMPANY: requires experienced man on Lucite & Acetated Plastic Ornaments Fabrication for sample department. Reply Box 1216, Modern Plastics.

PLASTICS PLANT MANAGER: Progressive corporation in Chicago area has executive position for qualified man with extrusion or injection expecience. Individual's personality as well as mechanical ability will be considered. Applicant having good experience background would be trained for this position. All replies will receive full consideration and be held in strictest confidence. Excellent potential. Salary open. Reply Box 1218, Modern Plastics.

PLASTICS ENGINEER: for establishment of a new factory in Germany, conversant with various modern plastics materials, working methods and main fields of application. Write Box X.G. 75 137 Carl Gabler, Munich 2/Germany.

MANAGER WANTED.
To Organize & Operate Vacuum Molding Division. We are looking for a man thoroughly experienced in vacuum forming. One capable of organizing & running such a Dept. for a well established Co. in an allied field. The man we are looking for may now be running his own business or he may be a foreman who wants to better himself. We want a man who is capable of taking complete charge, who understands costs, & all details of vacuum forming operations. All replies will be held in strictest confidence. Interviews will be arranged to suit applicant's convenience.
Reply Box 1210, Modern Plastics.

SALES MANAGER: To handle nationwide sales to manufacturers. Non-rigid and rigid plastics products such as bottles, enclosures, and industrial plastic applications. Established New England firm. Starting salary to $15,000. Replies strictly confidential. Company will pay employment expenses. Career Placement Services, 75 Pearl St., Hartford, Conn.

CHEMIST: recent graduate, B.S. or M.S., physical chemistry major, organic minor preferred; for applications research on new products, chemicals, fillers, polymers; experience desirable but not required. Diversified company in midwest. Send complete resume to: Personnel Department, Diamond Alkali Company, 341 Union Commerce Building, Cleveland 14, Ohio.

WANTED.
Experienced reinforced plastics engineers. Are you looking for a permanent position of responsibility where your skill and ability in the development of new reinforced plastic materials, processes and products will be recognized? If your interest and experience is in this field of important engineering endeavor, you may qualify for one of the openings now available at Boeing Airplane Company. In addition to the advantages of achieving professional recognition and advancement, you will be eligible to pursue advanced studies with company assistance in tuition. Also there is a liberal travel reimbursement plan, two weeks paid vacation each year, and a company-sponsored retirement plan. For additional information concerning these positions, send your resume today to:
John C. Sanders, Staff Engineer,
Personnel, Boeing Airplane Co.,
Department MP-1, Seattle 24, Wash.

PLASTIC CALENDERING: Qualified men experienced in unsupported vinyl for our new calender located Metropolitan New York area as Assistant Engineers—Research Chemists—Color Matchers—Foremen — Banbury — Mill — Calender and Compound Men—Top Wages—Ideal Working Conditions—Permanent Positions with future—Contact Mr. Al Novet, Rudd Plastic Fabrics Corp., 620-62nd Street, Brooklyn, New York, Telephone: GEdney 9-7433.

ENGINEER.
Chemical or Mechanical Engineering Degree. 5 years plant design experience, synthetic resins and plastics production preferred. Chemical or petroleum field considered. Permanent positions. Liberal employe benefits. Air conditioned offices. Convenient downtown location.
Apply Personnel Dept., 15th Floor
Barrett Division
Allied Chemical & Dye Corp.
40 Rector Street, New York, N.Y.
HA 2-7300, Ext. 2554.

PLASTICS EXTRUSION OPERATOR & Ass't Extrusion Foreman: Wanted by progressive New York City firm. Pleasant working conditions, chance for advancement unlimited by "seniority" and other restrictions. Excellent opportunity for right man—applications treated with strictest confidence. Write, giving full details to: President, Box 1201, Modern Plastics.

MOLD DESIGNER: For compression and injection molds. Should have knowledge of automatic operations, $1\frac{1}{2}$ years experience minimum, also work as liason between office and shop. Should have shop experience or knowledge of molding. Will also train. Benefits and advancement with a progressive company located near Philadelphia, Pa. Reply Box 1200, Modern Plastics.

(Continued on page 270)

FIBERGLAS *Reinforced* MOLDING COMPOUNDS

ALL THE PROPERTIES OF PLASTICS . . .

- **+ Heat Resistance**
- **+ Strength**
- **+ Dimensional Stability**

Pace-setting panel...

. . . selected for an outstanding car, the Continental Mark II. Here is a real achievement in molding techniques: 9 lbs. of Fiberglas-reinforced molding compound transformed into a 44-inch semi-structural panel which houses air conditioning ducts, ash trays, electrical wiring, window motors—and supports an arm rest in the bargain!

They chose Fiberglas molding compound because it alone possesses this combination of required properties and performance characteristics:

- Strength and Durability—
  structural strength supports,
  impact strength protects.
- Temperature-Resistance—
  unaffected by extremes of heat or cold
- Dimensional Stability—
  doesn't age, shrink, or swell.

In addition, Fiberglas molding compounds mean lower tooling costs . . . permit intricate molding of complex parts . . . cut assembly and fabricating operations . . . save production time. Its high molding accuracy eliminates extra machining.

END USER:
The Continental Division of
The Ford Motor Company

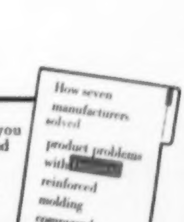
MOLDER:
Duralastic Products Company
Detroit, Mich.

MOLDING COMPOUND:
Fiberglas-reinforced polyester

It's amazing the difference Fiberglas makes!

write to OWENS-CORNING FIBERGLAS *Dept. 125H, Textile Products Division, 598 Madison Ave., New York 22, N. Y. for full list of suppliers.*

Free case history folder: If you haven't seen this recently issued file on case histories of products made with Fiberglas-reinforced molding compounds—plus a list of molding materials suppliers—send for your copy today!



(*Continued from page 268*)

PERMANENT POSITIONS: now open in California's fastest growing fiberglass firm for experienced Process Engineers, Aircraft Metal Design Engineers, Laminators, Finishers, Press Operators, Leadmen, etc. Write or call Personnel Manager, H. I. Thompson Company, 1611 W. Florence Ave., Inglewood, California.

PROJECT & PROCESS ENGINEERS: Our Company is committed to a five-year expansion program in chemicals and plastics which will afford outstanding advancement opportunities. Even now, we are building two plants—one in the East and one in the West—to manufacture the new low pressure type polyethylene. We have several positions open for Chemical Engineers qualified in either Project Engineering or Process Engineering. We have many interesting possibilities to offer and want to hear from you. Please address all replies to: Koppers Company, Inc., Chemical Division, Development Laboratory, P. O. Box 65, Monaca, Pa.

INJECTION SALES EXECUTIVE: Large established Midwest custom molder, immediate opening for sales manager or sales engineer, heavy experience in Thermoplastics. Write full details including salary. Box 1206, Modern Plastics.

RUBBER CHEMIST, TECHNOLOGIST. Minimum 5 years exp. compounding synthetic rubbers for specialty applications. Should know molding, extrusion, and fabricating practice. Background interest in research & development rather than production. Box MP 1871, 221 W. 41 St., N.Y. 36, N.Y.

FIBER GLASS: Reinforced Plastics production engineer sought by custom and proprietary molder. Experienced executive with knowledge of all Fiber Glass production processes. Unusual opportunity for the right man to ultimately manage production and work with top Management. Engineering Degree helpful but not essential. Heavy experience in this industry is a must. All replies held in strict confidence. Reply Box 1207, Modern Plastics.

ENGINEER—KEY POSITION: To head up Production Engineering Group for multiplant company in pigment dispersion field. Emphasis on processing thermoplastics. Process improvement, unit startup, equipment evaluation, plant tests, etc. Philadelphia area. Reply Box 1233, Modern Plastics.

ENGINEERS: Mechanical or Chemical. We have a desirable position available in our research and development laboratory for a recent graduate in mechanical or chemical engineering and a graduate engineer with up to 5 years experience to develop equipment for finished extrusion, vacuum forming and continuous processing by extrusion techniques. Eastern suburban location. Holidays, company paid insurance, vacations. Salary commensurate with experience and ability. Please furnish complete resume and salary desired. Reply Box 1214, Modern Plastics.

MARKET DEVELOPMENT & RESEARCH. B.S. or CH. or Ch.E. with 2-5 years experience in market development work. Box MP 1870, 221 W. 41 St., N.Y. 36, N.Y.

Situations wanted

MARKETING AND PRODUCTION: Executive. Custom molded and extruded products. All thermoplastics. Will establish a sales and product development program in rapidly expanding southwest United States. Establish production facilities if desired. Thorough knowledge of plastic applications in original equipment, petroleum, agricultural and other industries. Will function as consultant or direct representative. Reply Box 1204, Modern Plastics.

GENERAL MANAGER: Of plastic molding, vacuum forming and fabricating plant, age 34, desires to relocate. Experienced in all phases of administration. Resume sent on request to Box 1222, Modern Plastics.

DISTRICT SALES MANAGER: Midwestern U. S. Headquarters in Michigan. Custom molded and extruded thermoplastic products. Desires association with manufacturer capable of high volume production of parts for original equipment manufacturers. Have excellent contacts. Capable of cost estimating in field. Ten years experience on national market. Reply Box 1220, Modern Plastics.

EXTRUSION ENGINEER: 14 yrs. experience in all phases of thermoplastics extrusions. Die, tool and machinery design and construction. Production personnel and plant supervision. New plant installation and maintenance. Interested in financial investment also. Reply Box 1217, Modern Plastics.

SALES REPRESENTATIVES WANTED. New York Area Compounder and Extruder seeks representatives throughout the country to sell acetate molding powder. Also looking for sales agents to sell extruded rods, tubes and sheets. Excellent oppt'y with an expanding and enterprising firm. Reply Box 1212, Modern Plastics.

Miscellaneous

WANTED: Injection molds—one item or complete line of proprietary consumer articles, also interested in molds for industrial parts such as knobs, handles, fasteners, boxes, etc. Will consider purchasing complete injection plant with end products or parts line. Designers: New items wanted—cash or royalty. Victory Mfg. Company, 1722 West Arcade Place, Chicago 12, Ill.—Estab. 1930.

TRADING COMPANY: with first class connections to leading West German weaving and hosiery mills wants exclusive selling rights of American-made parts for looms; such as pickers, caps, buffers, etc. Replies are requested to No. 8502 c/o William Wilkens, Advertising Agency, Hamburg 1, Germany.

WHICH FIRM IS INTERESTED: in starting production of new plastics goods, suitable for export, in Germany, with young and enterprising German industrialist willing to invest 3-500,000 D-marks? Write Box No. L.G. Carl Gabler Adv. Agency, Munich 2, Germany.

WANTED TO BUY. A modern Plastic Plant with or without real estate. Equipped with injection, and/or vacuum and extrusion molding machines. Buyer is interested in a going business. Reply Box 1208, Modern Plastics.

WE WANT TO BUY: or to have on royalty basis, patents or know hows for new items made from PVC. Send your offer, comprising conditions, to: Ruhrkunststoff GmbH., Mulheim-Ruhr, Aktienstr. 107, Germany.

ESTABLISHED IN 1913: well known import-firm of resins in Hamburg, well reputed with firms in Germany and abroad, wants business connection with manufacturer of plastics or artificial resins for the paint and varnish as well as the chemical industry. "Ludosa" Drogen und Lackrohstoffe mbH, Hamburg 11.

FOR SALE. Cellophane Converting business and plant. Southwest side, Chicago. Good neighborhood. Ample labor supply. Fully equipped. Six Simplex machines and Slitter. Space for expansion. Building—one story brick, 4300 sq. ft.—good condition. Landscaped front. Five room apartment on second floor. Priced for quick sale $48,000. Terms to responsible buyer. Reply Box 1205, Modern Plastics.

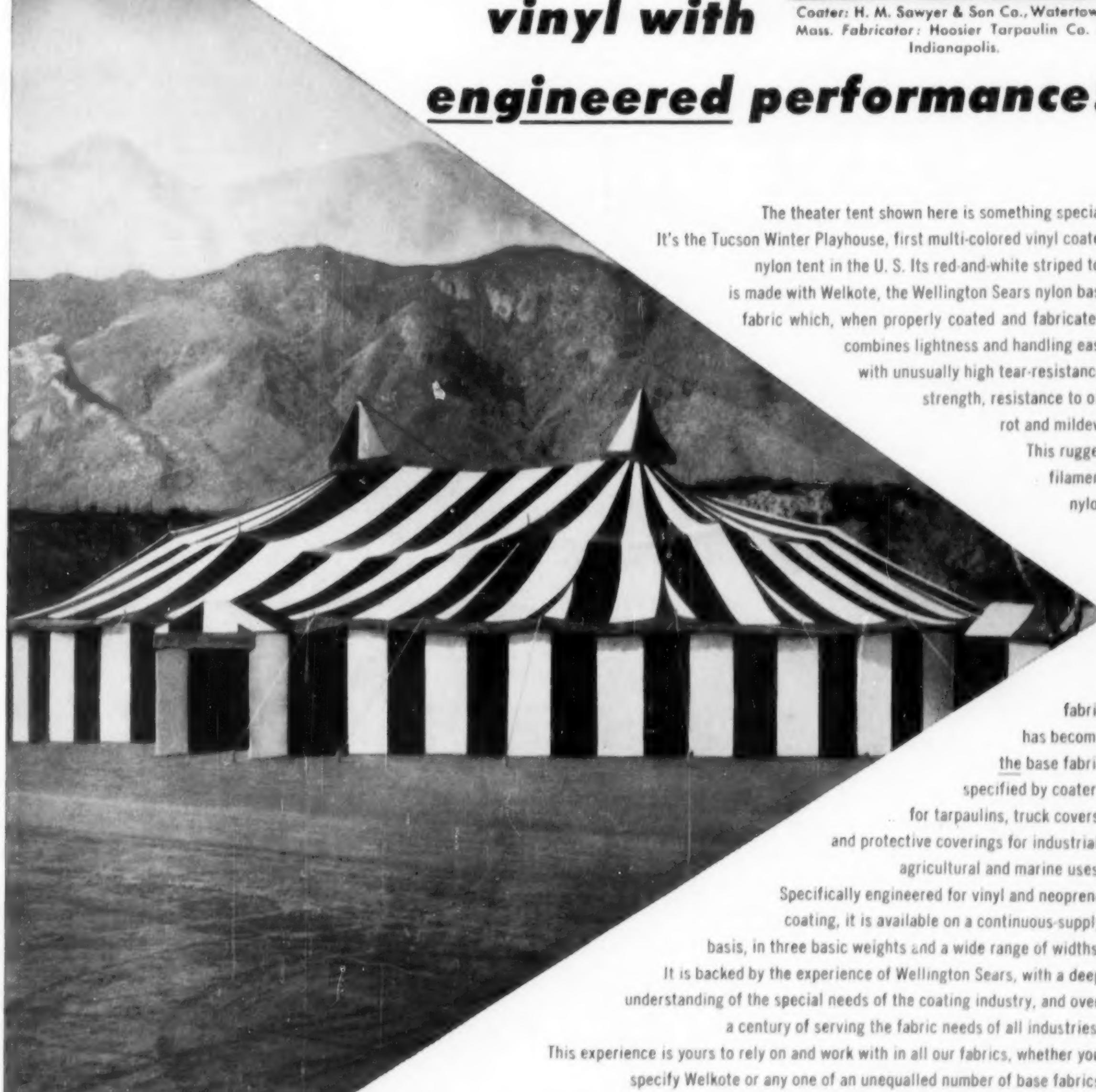
PARTNERSHIP WANTED: I will invest capital as active full-time working partner in operating Plastic Extrusion business. Possess full knowledge and have 10 years experience in straight delivery and cross head extrusions, tool room, dies, set up and operation of machinery, purchasing, sales, management. Metropolitan area preferred. Reply in confidence, Box 1211, Modern Plastics.

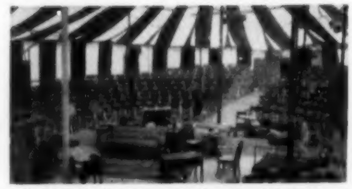
All classified advertisements payable in advance of publication

Closing date: 28th of the second preceding month, e.g., July 28th for September issue

Up to 60 words $10.00	Up to 120 words $20.00	Up to 180 words $30.00
Up to 60 words (boxed) $20.00	Up to 120 words (boxed) $40.00	Up to 180 words (boxed) $60.00

For further information address Classified Advertising Department, Modern Plastics, 575 Madison Avenue, N. Y. 22, N. Y.

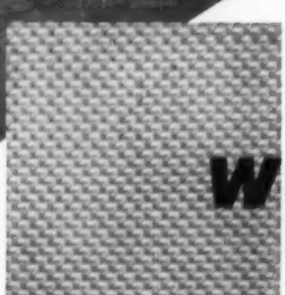




Coater: H. M. Sawyer & Son Co., Watertown, Mass. Fabricator: Hoosier Tarpaulin Co. of Indianapolis.

"Welkote" backs vinyl with <u>engineered</u> performance!

The theater tent shown here is something special. It's the Tucson Winter Playhouse, first multi-colored vinyl coated nylon tent in the U. S. Its red-and-white striped top is made with Welkote, the Wellington Sears nylon base fabric which, when properly coated and fabricated, combines lightness and handling ease with unusually high tear-resistance, strength, resistance to oil, rot and mildew. This rugged filament nylon fabric has become <u>the</u> base fabric specified by coaters for tarpaulins, truck covers, and protective coverings for industrial, agricultural and marine uses. Specifically engineered for vinyl and neoprene coating, it is available on a continuous-supply basis, in three basic weights and a wide range of widths. It is backed by the experience of Wellington Sears, with a deep understanding of the special needs of the coating industry, and over a century of serving the fabric needs of all industries. This experience is yours to rely on and work with in all our fabrics, whether you specify Welkote or any one of an unequalled number of base fabrics available for every coating use at Wellington Sears. For further information on Welkote, write Dept. **K8.**



Wellington Sears

A Subsidiary of West Point Manufacturing Company

FIRST In Fabrics For Industry

For Coated Materials, High and Low Pressure Laminates and Other Reinforced Plastic Products

Wellington Sears Co., 65 Worth St., New York 13, N. Y. • Atlanta • Boston • Chicago • Dallas • Detroit • Los Angeles • Philadelphia • San Francisco • St. Louis

Index of Advertisers

Modern Plastics, 575 Madison Avenue, New York 22, N. Y.

(Continued on page 274)


FLEXIBLE FOAM

Ideas Unlimited! *with*


ADHESIVES

URETHANES
based on
NACCONATES*


ELASTOMERS

National is going all-out to help users develop volume applications of the exciting new urethanes. We offer:

Assured Large-Scale Supply of a complete line of diisocyanates from our new multi-million dollar Moundsville, W. Va. NACCONATES (diisocyanates) plant. With this major plant coming on stream soon, urethane makers and users can confidently schedule volume production.

Comprehensive Product Data in a series of six National Technical Bulletins, the most complete "product-data package" available. Ask for Bulletins I-17 to I-17E.

Application Data on principal urethane uses are being developed for National NACCONATES users. Our major application research program now under way at our Buffalo Research and Engineering Center is developing practical starting formulas, test data and use results on such uses as flexible and rigid foams, coatings, adhesives, plastics, etc.

On-the-job Technical Service on production problems, assistance on polyester resin procurement and equipment-supplier contacts.

We invite you to use our across-the-boards help to broaden your uses of urethanes.

*Trademark


RIGID AND SEMI-RIGID FOAMS


WIRE ENAMELS


COATINGS

NATIONAL ANILINE DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 RECTOR STREET, NEW YORK 6, N. Y.

Boston Providence Charlotte Chicago San Francisco Atlanta Portland, Ore. Greensboro Philadelphia Richmond Cleveland Los Angeles Columbus, Ga. New Orleans Chattanooga Toronto

Allied Chemical

G-2

(*Continued from page 272*)

ORGANIC PEROXIDES

• BENZOYL PEROXIDE
• LAUROYL PEROXIDE
• MEK PEROXIDE

Technical Data and samples available on request.

Distributed by
McKESSON CHEMICAL DEPT.
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McKESSON & ROBBINS, INC.
155 East 44th St., New York 17, N. Y.
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CADET Chemical Corp.
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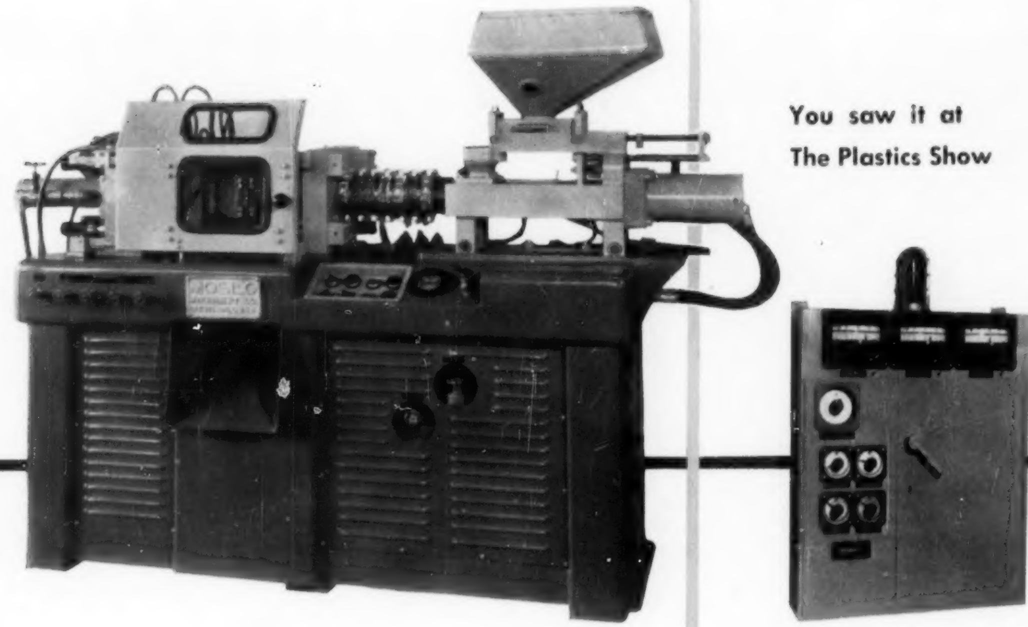


You saw it at The Plastics Show

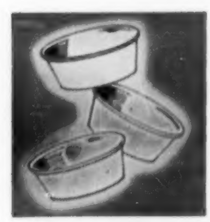
THE MOSLO 74-7-2

World's Fastest Injection MOLDING MACHINE

Simple in design and construction, fast, and low in maintenance cost, this Moslo Automatic Molding Machine is setting production records in industry.

Moslo machines are proving themselves on *performance* and *economy.*

Write today for more details.



More than 900 of these 6-ounce containers were molded per hour from a single cavity.

The Moslo line includes these models, ideally suited for container molding:

Model 74-7—Super 2 ounce with 7" mold stroke

Model 74-12—Super 2 ounce with 12" mold stroke

Model 75-8—High speed 3 ounce with 8" mold stroke

Model 75-15—High speed 3 ounce with 15" mold stroke

Model 76-9—Super 3 ounce with 8" mold stroke

Model 76-15—Super 3 ounce with 15" mold stroke

Models 10 & 11—Famous Duplimatics for insert molding

MOSLO MACHINERY COMPANY

2437 PROSPECT AVENUE • CLEVELAND 15, OHIO

Chemicals you live by

Why Diamond Technical Service is important to VINYL PROCESSORS

Completely equipped pilot plant is a part of the vinyl laboratory at DIAMOND's enlarged Research Center, Painesville, Ohio.

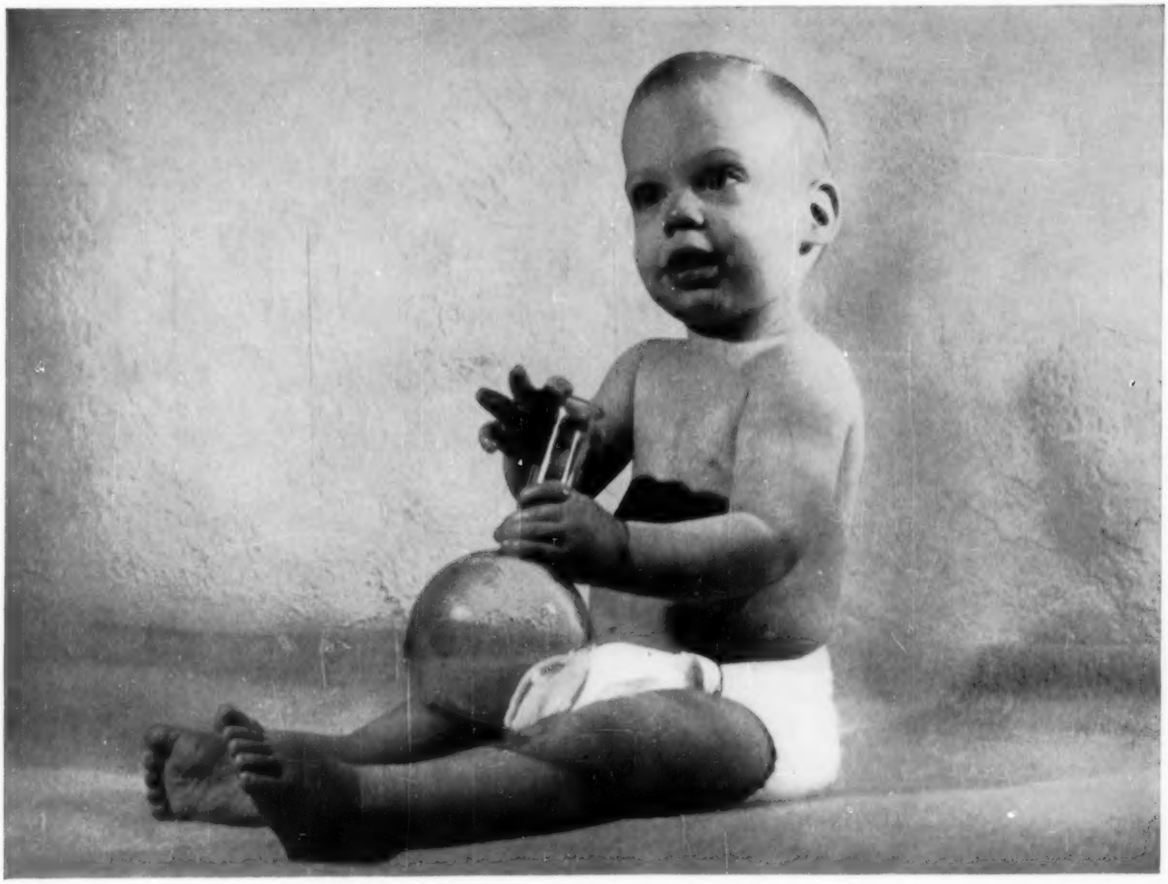
Here are two reasons: (1) our Plastic Products Laboratory evaluates and improves resins so that DIAMOND, and our customers, can make better products; (2) DIAMOND technical service is available to users, anywhere.

Introduced in 1954, DIAMOND PVC-50 and PVC-45 already are used satisfactorily in hundreds of formulations for extrusions, film, sheeting, and floor covering. PVC-50, suited especially for electrical insulation, has Underwriters' Laboratory acceptance, while PVC-45 offers lower temperature requirements.

Only high quality can explain quick success in a hotly competitive market. DIAMOND technical service can help you put that quality to work in your products. We're ready to work with you now. Call your nearby DIAMOND sales office or write DIAMOND ALKALI COMPANY, 300 Union Commerce Bldg., Cleveland 14, Ohio.

DIAMOND ALKALI CHEMICALS

Diamond Chemicals



How to Keep Your Production Chemist Young

THAT top-flight production chemist of yours may often wish he *were* enjoying his cradle days again—particularly when he's being haunted by production troubles due to variations in plasticizer quality.

We haven't heard of anyone yet who has found a better way to solve these problems than by specifying *proven, first quality materials.* When you specify *quality-controlled* Pittsburgh PX Plasticizers, for example, you enjoy these positive benefits:

1. Production problems due to inconsistent plasticizer quality are eliminated.
2. Expensive down time is minimized.
3. Far less quality control is required, freeing your chemist's time for other important work.
4. Customer complaints are reduced, costly adjustments and service calls cut to the bone.
5. Better end-product quality stimulates sales; reduced production costs increase your profits.

And you can add Pittsburgh's reputation for fast, reliable deliveries and the complete facilities of its technical service department. *Ask your Pittsburgh man for proof of these benefits. He has the complete story.*

PITTSBURGH *Job-Rated* PLASTICIZERS

PX-104 DiButyl Phthalate
PX-108 DiIsoOctyl Phthalate
PX-114 Decyl Butyl Phthalate
PX-118 IsoOctyl Decyl Phthalate
PX-120 DiIso Decyl Phthalate
PX-138 DiOctyl Phthalate
PX-208 DiIsoOctyl Adipate
PX-218 IsoOctyl Decyl Adipate
PX-220 DiIso Decyl Adipate
PX-238 DiOctyl Adipate
PX-404 DiButyl Sebacate
PX-438 DiOctyl Sebacate
PX-800 Epoxy
PX-917 TriCresyl Phosphate

PITTSBURGH COKE & CHEMICAL CO.

WBW 6200

COAL CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

general-purpose phenolics from General Electric

General Electric now offers molders two, new IMPROVED general-purpose phenolic molding compounds incorporating important advantages over previously available grades. Check these significant improvements:

- ✓ **Improved finish**—hard, glossy surface with maximum smoothness, minimum undersurface craze and roughness!
- ✓ **Greater versatility**—wider flow range; also suitable for both preheated pill and cold powder applications!
- ✓ **Longer flow duration**—improved ability to "flow further" without premature set-up!
- ✓ **Faster cure**—cure time equal to, or better than, practically any two-stage general-purpose material on the market today!

In addition, these new compounds offer unique G-E *low-erosion* characteristics to lengthen the life of your molds. Available as G-E 12920 Black and G-E 12921 Brown, these new improved general-purpose compounds are ready *now* to help you mold better plastic parts — more easily, more economically and more quickly!

Progress Is Our Most Important Product

GENERAL ELECTRIC

For more information, just write to General Electric Company, Section 6C5A1, Chemical Materials Department, Pittsfield, Mass.